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DELATTRE'S MODES:
ARTICULATORY SETTINGS IN APPLIED PHONETICS FOR ENGLISH-SPEAKING LEARNERS OF FRENCH

BY

DONALD H. SCHWEYER

A THESIS

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IN

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled DELATTRE'S MODES: ARTICULATORY SETTINGS IN APPLIED PHONETICS FOR ENGLISH-SPEAKING LEARNERS OF FRENCH submitted by DONALD H. SCHWEYER in partial fulfilment of the requirements for the degree of Master of Arts.

Supervisor

Date: October 13, 1987

To Shirley,

whose support was strongest

when it was needed the most.

ABSTRACT

Articulatory settings are seen by some linguists as being general habits which, to an extent, determine the phonetic shape of the individual segments in the sound system of a speech community. From this point of view, Pierre Delattre's *modes* can be viewed as a proposal of contrastive articulatory settings for French and English. This scholar explained the numerous phonetic difficulties in French pronunciation encountered by English-speaking learners in terms of three settings of the target language – muscular tenseness, open syllabification and anterior articulation – which contrast with three diametrically opposite settings of their native language. According to the theory, if learners can be led to alter their speech according to these three new *modes*, accent improvement with regard to other phonetic details should follow.

After a review of the literature on the topics of articulatory settings in general and Delattre's principles in particular, this thesis presents the results of a study in which subjects received instruction in central aspects of two of those *modes*. Their pretest and posttest pronunciation of French was evaluated with regard to these taught criteria, as well as with regard to other, untaught features. Pretest-to-posttest improvement scores for the untaught features were then correlated with those scores for the taught features. Results show varying values: some pairs of features have near one-to-one correlations, while others have no apparent relationship at all.

On the basis of the present findings, it is concluded that, while there is some evidence for the reality of articulatory settings, there is also evidence that not all pronunciation errors will disappear as a consequence of instruction in these generalities. Much investigation remains to be done before the limits of the spheres of influence of settings on phonetic product can be clearly known. Suggestions for the direction of future research are presented.

ACKNOWLEDGEMENTS

Though this thesis bears the name of only one author, it is by no means the product of the efforts of one person; many helped. The contributions of several must be acknowledged here.

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It is no doubt always the case that completion of a project of this type is in large measure the result of the contributions of those who taught the author. This thesis is no exception; and from that point of view, more have played a part than can be included here. Still, special mention must be made of the assistance offered by the members of my committee – and not only with regard to their reading and responding to the completed thesis. Professor D. Fearon guided me through my first experimental study. Professor T. Nearey, elected as advisor *pro tem* at various times, provided much invaluable help during the course of the present study. I am grateful to both.

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I. INTRODUCTION

In 1951 Pierre Delattre published a manual entitled *Principes de phonétique française à l'usage des étudiants anglo-américains*. In his approach to corrective French phonetics for American speakers of English he puts the entire task of correction into the context of three contrasting "modes" of French and English pronunciation:

French	English
mode tendu	*mode relâché*
mode antérieur	*mode postérieur*
mode croissant	*mode décroissant*

Broadly speaking, the *mode tendu* signifies tenseness of articulatory muscles during speech, and relative stability during articulatory states. The *mode antérieur* means a high proportion of front articulations. The *mode croissant* means primarily that open syllables predominate. The contrasting modes of English can then be defined in diametrically opposite terms. For the language instructor who favours a cognitive approach to phonetic correction, at least a part of the usefulness of these principles is obvious: they provide a theoretical framework which can help the student organize the multitudes of phonetic details for easier retention. In reading Delattre's little booklet, one has no doubt about the pedagogical thrust of the presentation:

> On négligera généralement la description *réelle* au profit de la description *corrective,* car pour arriver à acquérir des habitudes qui correspondent à la réalité physiologique de l'articulation, il faut souvent dépasser cette réalité pendant une période corrective prolongée. (Delattre 1951a: 2)

And though we seem here to be dealing with an exaggeration of linguistic reality, a later article on the same topic weakens the notion of the modes to the type of organizational framework mentioned above – i.e. which functions only on an intellectual level:

> La prononciation du français et celle de l'anglais diffèrent en tant de détails que l'étudiant – le professeur même – a de la peine à s'y retrouver. Aussi nous proposons-nous de ramener toutes les caractéristiques du français à trois modes ... (Delattre 1953: 9)

When we read some of this scholar's other writings, however, we see him describe linguistic reality according to his modes. At this point the significance of the modes progresses beyond the realm of pedagogy. More recently, a self-avowed disciple of Delattre, E. J. Matte, describes the whole evolution of French from Latin in terms of the modes. A central statement in this work is the following:

> Le terme "chaîne parlée" évoque l'image concrète d'une suite de chaînons entrelacés les uns aux autres et dont aucun n'est indépendant de l'ensemble. ... Les organes de la phonation fonctionnent selon des contraintes psycho-physiologiques de façon que chaque mouvement articulatoire est solidaire du réseau d'habitudes articulatoires qui gouvernent globalement la parole. ... les modes d'articulation changent et les éléments de la chaîne s'y accomodent presque simultanément. (Matte 1982: 43)

The statement shows us how deeply the modes are thought to penetrate into linguistic reality. They are seen to be far more than a pedagogical "gimmick". Matte's application of Delattre's modes shows us a powerful level of systematicity: a network of global articulatory habits which govern the production of the individual sounds of a language.

Seen in this light, they can be classified under the general headings of "articulatory settings" (Honikman 1964) or "voice quality" (Abercrombie 1969).

The plan for the review of the literature, then, is to consider some of the writings pertaining to this concept and secondly, to look in more depth at the modes as a description of contrasting articulatory settings for French and English. Thirdly, we reconsider the theory of the modes and propose an alternate framework which might be used to guide future research. We then examine some of the empirical research which has been conducted on the topic. Finally, the description of our own experiment, the results, and the conclusion are presented.

II. THE CONCEPT OF ARTICULATORY SETTINGS

Francis Nolan (1982: 442) has noted that "... 'voice quality' is a well-established and respected technical term within the speech sciences, its drawback being that it doesn't often mean the same thing twice in a row." With regard to "articulatory settings", which are generally included within the scope of that broader title, the situation becomes even more complex: in this case, we are confronted not only with several meanings, but with several terms, each of which has been assigned varied meanings. We will first look at some of the different labels which have been coined to represent more or less the same set of phenomena.

Those authors who deal with the history of the concept of articulatory settings place its origins in the seventeenth century.[1] In 1653 John Wallis wrote in his *Grammatica Linguae Anglicanae*:

> ... differences in pronunciation occur in various languages which are not attributable so much to the individual letters, as to the whole style of speech of the community. For instance, the English, as it were push forward the whole of their pronunciation into the front part of the mouth, speaking with a wide mouth cavity, so that their sounds are more distinct. ... The French articulate all their sounds nearer the palate, and the mouth cavity is not so wide; so their pronunciation is less distinct, muffled as it were by an accompanying murmur.[2]

In the late nineteenth century, in order to label these differences in pronunciation which span the individual "letters" or phones, German-writing scholars such as Franke, Jespersen, Sievers and Viëtor coined the terms *Mundlage, Operationsbasis,* and *Artikulationsbasis.* From these, it was the last title which came into general use (Kelz 1971: 195). In English, a contemporary of these authors, Henry Sweet, wrote of the same concepts under the headings, "voice quality" and "organic basis" (1906: 72-75). Walter Ripman, in his *Elements of Phonetics,* which is largely a translation of Wilhelm Viëtor's *Kleine Phonetik,* uses "basis of articulation" (1939: 98-100), while Viëtor, writing in English himself, uses "mode of articulation" (1890: 95-96). More recently, the terms "articulatory setting" (Honikman 1964), "articulation base" (Annan 1972) and "voice quality setting" (Laver 1980), all referring more or less to the same concept, have appeared in the literature. In the present discussion the term "articulatory setting" or "AS" will be used.

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[1] The historical development of the concept of articulatory settings will not be treated in this study. For an overview, see Kelz (1971), Laver (1978) and Wadsworth (1979).

[2] Quoted in Laver (1978: 2).

As was mentioned above, the notion of AS takes almost as many shapes as there are labels to refer to it. And though there is a good deal of common ground within these titles and definitions, it is almost general for scholars to extend the scope of their terms to limits of their own. Therefore, in the interest of having a point for comparison of some of the varied conceptions of "articulatory setting", it may be helpful to keep in mind one of the most succinct definitions to be found in the literature:

> By articulatory setting is meant the disposition of the parts of the speech mechanism and their composite action, i.e. the just placing of the individual parts, severally and jointly, for articulation according to the phonetic substance of the language concerned. ... Broadly, it is the fundamental groundwork which pervades and, to an extent, determines the phonetic character and specific timbre of a language. It is immanent in all that the organs do. (Honikman 1964: 73)

Kelz (1971: 203) cites Bithell (1952) as one of the very few authors to show a fundamental departure from a definition along the lines of that given above. This latter scholar equates "base of articulation" with "point of articulation":

> The main element of all articulation ... is the action of one organ which approaches or presses against some other organ .... The effect of such action is to reduce the space for the passage of air at some point or other of the vocal canal; this narrowed air passage is called the 'point (or base) of articulation... . (Bithell 1952: 57)

Later, in the same chapter, he makes a comment which is in line with the more usual ideas of articulatory settings, without however adopting a label: "Germans protrude their lips more than Englishmen, and this results in a variation of phonemes. (French requires even more lip action.)" (p. 58)

This writer's definition aside, common concepts connected with the term generally fall within the following bounds: a setting is a suprasegmental property of speech spanning "a stretch greater than a single segment ... [with] no upper bound to its extent in time" (Laver 1980: 3); it may be particular to an individual speaker (Laver 1978: 1) or to a whole speech community (Wadsworth 1979: 255); it may be within or beyond the control of the speaker, and in the latter case, the lack of control may be the result of anatomy, disease, or deeply-rooted habit (Abercrombie 1969: 92-93). These are rather frequently expressed ranges which the term "articulatory setting" is held to cover. Less common, though notable, is the extension of the concept into the realm of the paralinguistic. Wadsworth (1979), for example, speaks of the non-verbal messages conveyed by the external or visible aspects of articulatory setting and, from this point of view, sees it as "the nexus between NVC [non-verbal communication] and verbal communication" (p. 268). Laver (1980) argues that the full span of these properties needs to be studied and to be incorporated into phonetic theory. His point is well-taken; beyond that, for the field of Applied Linguistics, it is easy to see the potential value of parts of such study for application in speech pathology, for example. However, since the immediate concern for this study is with aspects which are valuable for corrective phonetics in second language learning, we must limit our concentration to articulatory settings which are said to pervade virtually all of the speech of whole speech communities.[3]

Within those bounds, a particularly salient point of divergence is in the power ascribed to settings, and statements in the literature on this point show remarkable variation. For example, Abercrombie (1969: 89) divides the "aural medium" into three components: (a) segmental features; (b) features of voice quality; (c) features of voice dynamics. Of the features of voice quality he writes:

> They originate in various muscular tensions which are maintained by a speaker the whole time he is talking, and which keep certain of the

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[3] This is not to say that more limited aspects of AS are of no interest in language instruction. Changes in setting for a shorter-term are probably of fundamental importance in stylistic changes. Delattre (1938), for example, speaks of the marked differences in rhythm – a central aspect of his modes as we will see below – between usual speech and emotional or emphatic styles. To this, we might add Drachman's (1973: 12) comment: "For different degrees of casualness in a given dialect it is likely that what is adjusted is not separate individual details ..., but simply the overall threshold setting for the system as a whole." With regard to settings which characterize less than the speech of a whole language community, Esling and Wong (1983) write of variation as an indicator of social level. Instruction in all of these could be very valuable at more advanced levels.

> organs of speech adjusted in a way which is not their relaxed position of rest. These adjustments give a kind of general 'set' or configuration of the vocal tract, which inevitably affects the quality of sound which issues from it. (pp. 92-93)

In this broader category of "voice quality", Abercrombie is clearly including – though not limiting himself to – those concepts contained in Honikman's definition of articulatory settings.[4] Later, of the three components of the aural medium – segmental features, features of voice quality and features of voice dynamics – he says:

> They are like three strands, separable though closely woven together, all simultaneously and continuously present and together making up the totality of the medium. These three strands may vary quite independently of each other from speaker to speaker; *there do not seem to be any necessary correlations between them* [emphasis added]. (p. 89)

Abercrombie here is presenting a view of voice quality which is substantially less powerful than Honikman's "fundamental groundwork which ..., to an extent, determines the phonetic character and specific timbre of a language". Essentially he is speaking of a property of speech – interesting and worthy of study in its own right – which accompanies articulation of individual segments, but from which those segments maintain their independence.

A second conception of the power of AS can be found in the writings of Laver, who acknowledges that Abercrombie's study of voice quality provided the impetus for his own work in the same field (1980: viii). Here, the notion of voice quality retains the broad scope of that held by Abercrombie, but phonic

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[4] It should be noted here that, though "voice quality" subsumes most of what is generally thought of as articulatory setting, speech rhythm (cf. note 3, above) falls under the category of "voice dynamics" (p. 95).

segments and settings do not always remained unconnected. In his introduction, Laver (1980: 3) writes:

> It is important that the analytic relationship between settings and segments should be stated as clearly as possible from the very beginning. It is not proposed that settings and segments are complementary divisions of phonetic quality. The standard attitude that phonetic quality should be fully exhausted by a comprehensive segmental analysis is maintained. The analysis of phonetic quality into settings is a second order analysis abstracting data from a prior segmental analysis. It is true that it will often be analytically convenient to discuss the relation between settings and segments as if a given setting had a perturbing effect on the articulation of some particular segment, and therefore had some notionally independent existence. It would be extremely tedious to have to spell out the analytic priority of segmental analysis at every mention of the relationship between segments and settings. Let this discussion stand, then as a general caveat. Having said that, it is also true that a phonetic theory which incorporates an account of settings as well as segments is demonstrably a richer theory, with wider application, than one which focuses merely on the first-order description of segmental performance.

Laver's statement recalls that of Delattre (cited on page 2) in which settings are seen to be generalizations which function as a framework within which to organize phonetic details on an intellectual level only. As such, they would serve to simplify linguistic descriptions, but, rather than controlling the shape of phonological segments, they are determined by them.

On the opposite end of this continuum one can place the conceptions of articulatory settings expressed by Trudgill and Drachman. In his sociolinguistic study of phonological variation in Norwich, Trudgill (1974:185) states:

> It is a striking fact that the speech of many Norwich informants whose individual segments are otherwise quite or perhaps very similar actually sounds very different. This difference is due to the use by very many (particularly younger) WC [working-class] speakers of

> what several informants referred to during the course of the interviews as a 'Norwich voice'. In those cases where there are slight differences in the pronunciation of individual segments, moreover, these often seem to be due to the same overall difference in the mode of articulation. Both these types of difference can be described as differences of *setting.*

The first part of Trudgill's comment speaks to a situation in which an overriding setting has an influence on language at the *perceptive* level: though individual segments are not significantly altered by the setting, the overall sound of speech is changed considerably. In the second part he is speaking of influence on the level of production: divergence in setting is held to be the cause of real pronunciation variation in those segments.

This powerful conception of AS is perhaps summed up best by Drachman (1973: 7):

> ... I want to propose that if a small number of mechanisms or attitudes in the tract control a diversity of phonetic processes, so that the activation of one set is made most plausible while that of some other set is rendered most unlikely, then the processes concerned exhibit a *causal* unity. Thus the Basis of Articulation constitutes a causal principle with reference to the processes which it provokes or blocks for a given language.

In this statement, we see how deeply articulatory settings are thought by some writers to influence the shape of phonetic segments. They are seen to be far more than an intellectual construct. Students of language are fond of speaking of sound "systems" of languages, but we seldom see such systems as really being more than arbitrary collections of phones. Drachman's concept of settings shows us a powerful level of systematicity, very similar to that attributed to the *modes* by Matte (cf. page 2 above): an overriding system of habits which exert a kind of control over the individual sounds of a language. The logical conclusion is that certain kinds of phones cannot exist under the control of a given global tendency, and ultimately, that they and certain other kinds of phones cannot co-exist within a single system.

Having considered the question of the power of control ascribed to articulatory settings, we now move on to look at the type of reality out of which they are thought to operate. For some writers this is, at least in part, statistical; for example, consider Honikman's (1964: 76) statement:

> The internal articulatory setting of a language is determined, to a great extent, by the most frequently occurring sounds and sound combinations in that language. Since it is the articulation for consonants that interrupts or impedes the free flow of the air stream through the mouth, the setting required for the most frequent consonants has an important bearing on the articulatory setting – no less important than that required for the most frequent vowels.

It should be noted that this approach, wherein one defines a setting according to the most prevalent features across individual segments, inevitably requires some kind of comment or qualification to deal with segments not sharing those "typical" features, or which contain features opposing them. Thus, in a footnote to the above statement, Honikman (p. 84, note 9) writes: "Once the main setting is established, adjustments for the lesser used sounds can be comfortably made." Similarly, Sweet, who notes that English retraction of the tongue "is unfavourable to the formation of teeth-sounds" (1906: 74), must stipulate later (p. 75) that "no language ... carries out the tendencies of its basis with perfect consistency"; he mentions English [θ] as an example of such lack of consistency. We will return to this notion below; for now, let it suffice that we note this definition of setting according to statistical parameters as a part of the AS tradition.

Whether or not the above is an aspect of a given author's concept of articulatory setting, it is general to find in it some sort of biological dimension. Some early writers attached a great deal of importance to the rest position of the speech organs. While there is no mention of this in the writings of two of the pioneers of the concept – Sweet (1906) or Viëtor (1890)[5] – a third writes the following:

> Ferner gehört hierher namentlich auch eine durchgehends bei allen Vocalen des Systems abweichende Lagerung der Zunge, die von Differenzen in der Ruhelage der Organe herrührt und die man jetzt meist mit F. Franke als die specifische Articulationsbasis der betreffenden Idiome zu bezeichnen pflegt … . (Sievers: 1901: 114)

A liberal translation of the above renders the following:

> Beyond this, there is involved here a diverging position of the tongue which pervades all the vowels of the system, and which has its source in differences in the rest position of the organs; one usually refers to this, to adopt F. Franke's term, as the specific Basis of Articulation of the languages concerned.

This rest position of the speech organs, which was held to differ from one linguistic community to another, could easily be seen as a genetically determined anatomical difference:

> The *articulatory basis* is generally described by phonetists as the peculiar position of the various parts of the speech organ when at rest. This neutral position is different in different languages and is the result of both hereditary and acquired habits. (Graff 1932: 224-225)

Spurred on, no doubt, by the European political climate in the '30s and '40s, some authors attached considerable importance to the role of the genes in this matter (Wadsworth 1979: 260), but linguists eventually dropped the unproductive question, attributing language-specific differences instead to learning (Francescato 1968: 179).[6] That issue aside, the matter of the absolute rest position of the speech organs has been accorded enough importance for Pei (1966: 29) to define "basis of articulation" as "the over-all neutral position of the speech organs and their various parts *when not speaking* [emphasis added]".

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[5] Nor is it to be found in the selection of Sweet's writings edited by Henderson (1971) or in Ripman's (1939) translation of Viëtor's *Kleine Phonetik.*

More recently, the framework out of which settings are thought to operate is conceived of as physiological – as involving the functions of the organs for speech-specific tasks. Bithell (1952: 57-58), for example, has noted the need to distinguish between the absolute neutral position (*Indifferenzlage*) and "the position of readiness to speak before the organs required for the sound become active" (*Sprechbereitschaftsbasis*). And though Chomsky and Halle (1968: 300-301) have presented this latter position as a universal (which, of course, would rob it of any significance it might have as a factor involved in language-specific articulatory settings), their argument is far from universally accepted.[7]

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[6] Both Wadsworth and Francescato cite evidence for the lack of importance of heredity in determining the phonetic realization of language.

[7] In this regard, see Annan (1972) – as well as Paddock's response to Annan (p. 1082), Drachman (1973) and Matte (1982: 39). Though anecdotal support for a position is weak support indeed, on the basis of that alone, the French-English bilingual is not convinced of the universality of the speech preparedness stance. Honikman (1964: 10) speaks of getting into an English or French "gear". When one attempts to insert a French word into an English sentence, or vice-versa, it becomes

It is not uncommon, then, for the physiological dimension of articulatory settings to begin with this speech-ready neutral position; but rarely does it end there. For most writers, settings include, in addition, some kind of notion concerning the manner in which articulators move away from and return to the neutral – and that from the very beginnings of the idea. Consider the dynamism in this description by Viëtor:

> The *French* mode of articulation is more definite, more tense than ours: the tongue is in general much farther forward in the mouth. The lips are very active: they are strongly rounded or protruded, or the corners of the mouth are well drawn back; and the mouth is smartly opened. The timbre of the voice is bright and clear; and there is enough modulation to make us easily distinguish the musical intervals. The exhalation of breath is more uniform than in English (or German), and indeed tends to increase in force as it goes on. (Ripman 1939: 99)

It is because of the aspect of movement that Wadsworth (1979: 256) prefers Honikman's label "articulatory *setting*":

> ... setting is to be preferred to base or basis because it is an implicitly dynamic term and thus obviates the dichotomy inherent in the essentially static term basis. Namely, the confusion between the position of the organs of speech at rest and their overall configuration during speech.

Without dwelling on the appropriate choice of label, we use the above statement to stress the fact that, for most writers on the notion, the fundamental concept associated with articulatory settings is one of *how* articulators do their articulating.[8]

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undeniable that the two gears are not the same.

[8] It must be noted, however, that Viëtor's (1890) "mode of articulation", which was also used (perhaps coincidentally) by Delattre (1951) conveys as much dynamism as any of the labels; furthermore, it is the only one which speaks at all to the *how* of articulatory movement.

Before terminating this brief look at some of the literature dealing with articulatory settings, we should mention three authors who have proposed auditory dimensions to the notion. Graff (1932: 225) suggests that, walking hand-in-hand with the articulatory basis, there is an "auditory basis" which he defines as "the basis from which the speakers of a language identify various acoustic shades as unimportant variants or as significant and essential phonetic differences." Together, the two bases are "at the same time the effect and also the preserving cause of the particular sound system of a language." He then portrays the two as being together responsible for substitution of native language sounds for target language segments.[9]

Francescato (1968: 178) has noted that, for any language, there is "a 'normal' realization of phonetic sequences, which is identified by the native speakers according to their perception-habits, and which usually reaches deeper than the phonemic level." To account for this, he proposes the following:

> We suggest that the role traditionally attributed to the controversial 'basis of articulation' be attributed instead to the native pattern of phonetic habits. According to this view, the phonetic patterns – or its units – are to be interpreted as 'Gestalt-like' formations, which become established through a series of very early experiences, and tend later to be super-imposed upon every other experience of the same kind. (p. 180)

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[9] With regard to the auditory basis, Graff is speaking explicitly of phoneme theory, but he presents no explanation of how that basis is held to function. If we heard speech through the filter of our phonemic system, we would be unable to detect foreign accent. Apparently then, he is saying that the learner perceives divergences from his native-language norms, but that he judges these to be unimportant; when he speaks then, he naturally uses the allophonic distribution of his first language.

On the production level these phonetic units become "psycho-physiological units" through a process of "motor commands". (p. 182)

In a similar vein, Drachman (1973: 8) notes the imperfect relationship between articulatory procedures and the end acoustical product and concludes: "An absolute specification of the Basis of Articulation may thus prove elusive even in principle." He then proceeds to suggest that we "... consider the Basis itself to constitute a global adaptation to the processes *heard* to operate in the language concerned."

Drachman's point concerning the lack of a one-to-one correspondence between articulation and product is well-taken. And there is other motivation for positing some sort of auditory basis, for there is evidence enough to lead us to agree with Francescato (1968: 181) that beginning language learners do hear second-language sounds as "normalized" sounds of their native language.[10] Nonetheless, at this point, no description – which has been stated in terms precise enough to be testable – of how perception relates to production has presented itself. That point aside, though it must be admitted that acoustic product fails to be adequately defined by articulatory specification (i.e. that identical sounds can be produced by more than one articulatory procedure), we must not treat articulatory description as unimportant: for from the moment that a *majority* of speakers of a given language use virtually identical articulatory procedures to produce sounds that are interpreted as identical, those procedures constitute a linguistic reality which must be dealt with. From a practical point of view with regard to phonetic correction, in light of the fact that mere listening and repeating yields such meagre progress (Politzer and Weiss 1969: 79-81; and Locke 1970), it appears at this point that articulatory description is the best tool teachers have at their disposal.

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[10] Language teachers are all familiar with the following kind of experience: Having offered [vwatyʁ] to a student as a correction for a mis-pronounced *voiture*, we hear the retort: "That's what I said – [vwatʃɚ]."

To summarize in broad terms, then, there are to be found in the literature two different concepts of articulatory setting. For some, it appears to be a construct – an intellectual generalization – originating in the most commonly shared features of the sound segments of a language. For others, the notion holds considerably more power. In this view, articulatory settings are dialect-specific articulatory habits which, to an extent, determine the shape of individual phonetic segments. They function on a physiological level in which salient aspects are the direction and distance of articulatory movements in relation to the neutral speech position of the articulators and the manner in which those movements are effected.[11]

One cannot fail to note the similarity of the second of these notions of articulatory settings and Matte's "réseau d'habitudes articulatoires qui gouvernent globalement la parole" (1982: 43). Consider also Delattre's (1945: 216) statement concerning the fate of Latin in the province of Gaul:

> Les Romains, grâce aux écoles et à la supériorité de leur civilisation purent imposer leur langue. Mais les Gaulois avaient des habitudes articulatoires relâchées qui n'étaient pas faites pour le latin. ... Dans leur bouche aux muscles détendus, les voyelles pures se

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[11] Both the intellectual construct and the physiological habit could, of course, be given application in the pedagogy of phonetic correction, yet the forms of those applications would have to be very different. See page 54, below.

> diphtonguèrent ..., les consonnes pures se palatalisèrent et s'affriquèrent ..., et ils supprimèrent graduellement toutes les syllabes faibles, c'est-à-dire plus d'une syllabe sur deux.

The concept of the *modes* in the writings of both of these scholars clearly fits into that of articulatory settings as it is expressed above.[12] In this light we will now consider the modes and the influence they are said to exert on the production of the individual phonic segments of the speech chain.

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[12] It should be noted that there has been very limited acknowledgement of the similarity. That Delattre has not cited the writings of those who speak of articulatory settings is understandable, since most of his writings on the modes pre-date the revival of interest in AS that was sparked by Honikman's (1964) article (though he does mention the "neutral vowel position" as being indicative of "the center, or basis, of articulation"(1964a: 93)). On the other hand, Matte's (1976, 1982) publications fall well within the time framework of that revival, yet mention neither the terms nor the authors associated with the notion. Similarly, in spite of the terminological differences, the paucity of citations of Delattre's work on the modes remains surprising. He is cited by Ozga (1976) in contexts only remotely related to the modes. Laver's (1979) classified bibliography lists only his article (Delattre: 1954) on the acoustics of nasality, in which there is no mention of the modes. Among the authors consulted for this study, only Drachman (1973) really makes the connection between Delattre's modes and AS.

III. DELATTRE'S *MODES*

The limits of the spheres of influence of Delattre's three modes are not rigidly defined and the reader quickly notices that there is considerable overlapping of those spheres. As Delattre (1953: 9) himself notes, "Ces modes ne s'excluent pas rigoureusement ... et telle caractéristique phonétique se rapportera inévitablement à plus d'un de ces modes à la fois ..." Moreover, he cautions that the limits which he has drawn do not necessarily correspond to limits which exist in linguistic reality: "Il est possible que ces trois modes n'en fassent qu'un, ou que l'un des trois entraîne les deux autres. Mais tant que cela n'a pas été démontré, nous retiendrons la distinction." (1951a: 37) What follows then, is a presentation of the definition of each mode together with a listing of the phonetic influences that seem to be central to that mode.

Modes Tendu and *Relâché*

> Parler sur le Mode Tendu signifie d'une manière générale qu'il y a grande dépense d'énergie pour tendre les muscles d'articulation pendant la phonation. ... De cette tension musculaire, il résulte une certaine stabilité du timbre des sons au cours de l'articulation. ... la séparation des organes en contact se fait bien plus vivement qu'en anglais.[13] ... Il faut aussi expliquer par la tension le rythme si particulier de la chaîne parlée française, rythme produit par la presque égalité des syllabes qui se succèdent.[14] ... La tension

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[13] In Delattre (1951a: 58), rapid transition movements – both opening and closing – are included.

[14] The notion of syllabic equality will be treated below. For the moment it should be noted that for Delattre (see, for example, his explanation in (1951a: 43)), this equality is not absolute, but lies in the fact that, in French, stressed syllables are marked by length alone, rather than by length and intensity, and that unstressed syllables are relatively equal in both duration

> permet enfin de donner aux syllabes françaises une intonation relativement "plate". Nous voulons dire par là que le ton sur lequel une voyelle est lancée se maintient sans grand changement jusqu'au bout. Pas de glissements vers le grave ou l'aigu comparables à ceux de l'anglais. En français les écarts de tons se trouvent entre les voyelles plutôt que pendant les voyelles. (Delattre 1953: 9-10)

To this definition of the *mode tendu*, Matte (1982: 63) adds a division of roles among articulators: "La mâchoire inférieure s'occupe surtout de l'aperture des voyelles, tandis que l'articulation des consonnes est surtout fonction de l'action des lèvres et de la langue."

This articulatory habit, or set of habits, results in less diphthongization of vowels, less affrication of consonants (Delattre 1953: 9-10). Elsewhere, Delattre mentions the lack of palatalization of consonants before [j] (1951a:12), relative lack of reduction of unstressed vowels (1943: 505),[15] and lack of weakening of consonants in intervocalic position (1946a:19). To these effects of tense articulation, Matte (1982: 133) adds what he calls centrifugal vowel articulation in which all articulatory features of a vowel are maximally distinguished from those of a central or "neutral" vowel and from those of the other vowels of the system.[16]

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and intensity. Matte (1982: 63) attributes this equality to muscular tension realized as muscular control: "[Le mode tendu] se caractérise par le contrôle exercé sur les muscles des organes pendant la phonation; ... Tous les sons de la chaîne parlée sont articulés énergiquement sans qu'il y ait renforcement perceptible des uns aux dépens des autres."

[15] Delattre is speaking here of the complete disappearance of Latin atonic vowels in Gallo-Romance as a consequence of lax articulation, but the first stage of that falling is the reduction or weakening of the vowel. See also Matte (1976: 468-469).

[16] In articulatory terms, all movements and positions are extreme: high vowels are very high, low ones are very low; the same can be said for

The above, then, represents a brief characterization of the central aspects of the *mode tendu* which is held to characterize French articulation. Characteristic of American English, on the other hand, is the *mode relâché*, which is defined in diametrically opposite terms: Matte (1982: 60-61) expresses them thus:

> ... le mode relâché représente surtout une répartition relativement égale de l'effort articulatoire parmi les articulateurs mobiles, surtout dans l'articulation des consonnes, et une répartition relativement inégale de l'énergie parmi les éléments de la chaîne parlée. ... [sous l'influence de ce mode] on tend à avoir recours à la mâchoire inférieure, l'articulateur le plus fort, pour faciliter le travail des lèvres et de la langue. Et plus la mâchoire inférieure s'emploie dans la production des consonnes, moins les lèvres et la langue ont à se dépenser et, par manque d'exercice, plus elles perdent leur agilité.

Matte then continues to present the results of these physiological processes: slow and imprecise articulatory movements, unstable articulatory states, diffusion between vowels and surrounding consonants, centripetal vocalic oppositions, and rhythmic irregularity (p. 61).

Modes Antérieur and *Postérieur*

> Parler sur le Mode Antérieur veut dire porter les lieux d'articulation, les centres des cavités de résonance, le plus possible vers l'avant de la cavité orale. La forme concave et bombée de la langue, l'arrondissement des lèvres, en sont les marques les plus concrètes. ... Le lieu d'articulation reculé de l'*r* parisien (friction entre le dos de la langue et le fond du voile du palais) n'est, malgré les apparences, qu'une manifestation de plus de cette antériorité; c'est grâce à cet *r* dorsal que la langue peut conserver sans interruption la position

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fronting and backing and for lip rounding and spreading. In graphic terms, one can imagine a system in which all vowels have fled the centre of the vowel triangle to place themselves on the perimeter (cf. Matte (1982: 51)).

> bombée convexe qui favorise la résonance antérieure générale. (Delattre 1953: 10-11)

The above seem to represent some of the most necessary aspects of the specification of the *mode antérieur*, which contrasts with the posterior articulation, weak lip rounding and concave (retroflexed) tongue shape of English. With regard to the influence of the mode on phonetic product, Delattre notes that since French anticipates the position of a vowel in articulating a preceding consonant,[17] any consonant which is followed by a rounded vowel is itself articulated with rounded lips. Failure to practice this procedure results in diphthongization of the following vowel. He further mentions that "L'effet auditif [du mode] fait dire 'voix française', tandis qu'une certaine résonance postérieure, pharyngale, est caractéristique de la voix parlée américaine." (*ibid.*). Additionally, Matte (1982: 30) attributes the English dark *l* to the habitual concave shape of the tongue. These three features are presented quite clearly as results of the mode. However, it must be mentioned that, at times, there seems to be confusion as to whether certain features are taken to be causes or consequences of the mode. For example, Delattre mentions the fact that apical consonants are dental, rather than alveolar, but provides no indication of the status of that feature (1953: 11). The *r* is presented here as a controlling facet of the *mode antérieur*, rather than as a product. Similarly, in Delattre (1951a: 61) the *r* is called "la clef de l'antériorité". By contrast, while affirming the importance of the back articulation of this sound, Matte (1982:137, note 110) is referring to this expression – "clef de l'antériorité" – when he says that "l'expression [est] inexacte quant à l'origine, le *R* est plutôt le résultat du mode antérieur et non pas sa cause". In Delattre (1944d:207), it is presented as a result, not of the *mode antérieur*, but of vocalic anticipation, a central aspect of the *mode croissant*:

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[17] Vocalic anticipation will be discussed under the *mode croissant*.

> The history of modern French *r* must have taken place in two phases. In the first phase, uvular trilled *r* coexisted with and gradually replaced apical trilled *r*. ... In the second phase, the uvular trilled *r* became a fricative *r* without changing its point of articulation. ... Those two phases were necessary to satisfy the French tendency to vocalic anticipation: during the French articulation of the consonant, the tongue always tries to take the position of the following vowel, thereby eliminating diphthongization. This vocalic anticipation requires as much freedom of the tongue as possible. With the apical *r* keeping the tip of the tongue occupied, the vowel position could not be anticipated and a transitory movement from *r* to the following vowel was inevitable. The change from apical to uvular *r* was a first step to liberate the tongue; then the change from trilled to fricative *r* completed the liberation of the tongue, allowing it to articulate the *r* while holding in advance the position of the following vowel.

In attempting to underscore the reality of the *mode antérieur*, Delattre (1951a: 57), stressing the importance of rounded lips as an aspect of anteriority (lip rounding in French also entails extreme projection), notes that a majority of French vowels bear the fronted marking of rounding.[18] In a similar vein, Matte (1982:142) offers other statistics in support of both vocalic and consonantal anteriority. It must be noted here that, if statistical evidence concerning a given feature is being presented to show the existence of the mode, that feature cannot be construed to be a consequence of the mode. On a theoretical level, then, we are left then with four phonetic products – lack of diphthongization of rounded vowels, clear timbre of *l*, "French voice", and (perhaps) dental articulation of apical consonants – which are held to result from the *mode antérieur.*

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[18] In this light then, with the exception of the *a*'s, all vowels (including the back ones!) are fronted, either by virtue of their point of constriction ([i, e, ɛ, ɛ̃]), of their rounding ([u, o, ɔ, ɔ̃]), or of both ([y, ø, œ, œ̃]). (Delattre 1951a: 59)

Modes Croissant and *Décroissant*

> Parler sur le Mode Croissant signifie donc que voyelles, consonnes, syllabes (et l'on pourrait même appliquer le terme à des groupes de syllabes) s'articulent dans un effort soutenu – un effort qui ne se déclare pas, dans une syllabe, au début de la voyelle pour se relâcher aussitôt, mais qui commence sans brusquerie, augmente fermement et se maintient jusqu'au bout de la voyelle. Après l'ouverture buccale prolongée de la voyelle, le mouvement fermant est vif, il appartient plutôt à la transition syllabique (entre voyelle et consonne) qu'à la voyelle même. De la sorte, une consonne intervocalique tend fortement à se rattacher à la voyelle qui suit, et inversement tend à se détacher de celle qui précède. Parler sur le Mode Croissant veut aussi dire que les voyelles prennent psychologiquement une place dominante dans les syllabes, et qu'ainsi, dans le cours des mouvements articulatoires de la chaîne parlée, le français tend à prévoir la voyelle plus que la consonne, contrairement à l'anglais où la tendance à l'anticipation consonantique est si caractéristique. (Delattre 1953: 12)

Under this articulatory habit, syllables are open – end on a vowel, rather than on a consonant[19] – and consonants are articulated with features borrowed from the following vowel – thus, in *pis*, for example, [p] is pronounced with tightly spread lips, while in *poux*, it is said with rounded and protruded lips.

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[19] Delattre qualifies that this explanation must be understood in relative, rather than absolute terms "pour souligner le contraste avec ce qui se passe en anglais"; no syllabic movement is completely increasing – i.e. no syllable is completely open (*ibid.*)

Once again, the contrasting *mode décroissant*, which characterizes American English, is defined in opposite terms.

The consequences of the mode mentioned in this article are lack of devoicing of voiced occlusives, lack of aspiration of voiceless occlusives, clear release of group-final consonants,[20] and independence of vowels from following consonants – for example, no nasalization of vowel before nasal consonant (e.g. *peine* [pɛn] → [pɛ̃n]), and no intrusive nasal consonant between nasal vowel and oral consonant (e.g. *peinte* [pɛ̃t] → [pɛ̃nt]). Elsewhere, Delattre (1951a: 40) adds the prevention of inappropriate dropping of unstable *e* (e.g. *appartement* [apartəmɑ̃] → [apartmɑ̃]).

The Overlapping Spheres of Influence of the Modes

It has already been noted that the sets of those phonetic features controlled by each mode (and indeed, even of the defining traits of the modes) show considerable areas of intersection. Consideration of those overlappings is quite revealing.

Three of the defining principles which we have shown for the *mode tendu* are stated in connection with the *mode croissant*. Matte (1982: 62) relates syllabic equality to this latter mode. Delattre (1951a: 43) recommends vocalic anticipation as a means of achieving that equality. Similarly, he recommends maintaining open syllabification as an antidote to intonational subsumed under the rubric of this other mode by Matte (1982: 40, 62). It is no doubt a consequence of the displacement of these principles from the realm of one mode to that of another that we see a similar displacement of individual products of the *mode tendu*. Through consonant anticipation, diphthongization becomes a product of the *mode décroissant* (Delattre 1944c: 371). To these, Matte (1982) adds affrication, palatalization (pp. 38-40), lenition of consonants in all weak positions (p. 48)[21], and unstressed vowel reduction (p. 62).

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[20] Delattre (1951a: 64) states: "En français, la détente [des consonnes finales] est toujours présente. Elle est même si nette qu'elle engendre à sa suite une ébauche de voyelle... ." Matte (1982: 62) adds: "C'est comme si une nouvelle syllabe allait commencer."

Concerning the *mode antérieur*, on the surface at least, there is little overlap; the only one of the mentioned aspects which is related to a different mode, either at the definitional or consequential level, is the maintaining of clear timbre of *l*, which Delattre (1951: 40) and Matte (1976: 471) relate to open syllabification, and which Delattre (1964b: 51) sees as a result of articulatory tenseness.

By contrast, more aspects of the *mode croissant* are displaced. With regard to the defining principles of the mode, Crooks *et al.* (1943: 505-506) relate consonantal anticipation to the *mode relâché*. At the product level, we find problems of voice onset timing (i.e. aspiration of voiceless occlusives and devoicing of voiced consonants) attributed to articulatory laxing (Delattre 1951a: 53) and, in the same book, articulatory tenseness is recommended in the effort to avoid both intrusive nasal consonants and nasalization of vowel before nasal consonant (pp. 41, 43).

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[21] Though the *mode croissant* is not specifically mentioned in this connection, Matte is speaking of attenuation of articulatory effort by *anticipation* of subsequent effort.

IV. THE MODES RECONSIDERED

The overlapping of the spheres of the modes described above creates considerable confusion in the mind of the reader of the cited works – confusion which potentially robs the theory of a great deal of its power. Both for the researcher who wishes to test aspects of the influence of the modes on speech product and for the language teacher who wishes to make efficacious application of the modes in the phonetic correction segment of the curriculum, it is imperative that individual features be clearly linked with the settings from which they are said to issue. And indeed, with some additional depth in the consideration of the literature, we find that the amount of confusion can be lessened, if not eradicated.

— The *Mode Antérieur*

In the quest for further clarification, the greatest strides can be made by looking once more at the *mode antérieur.* On the surface, it would seem to be the most unassailable of the modes, for in the works consulted on the topic of articulatory settings, front resonance is the one almost universally mentioned attribute accorded to French.[22] With regard to the question of overlapping, only clear *l* has been attributed to other modes. Finally, as was been noted, there is statistical evidence to support the existence of anterior articulation.

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[22] For example, Graff (1932: 269) states that "a trend of French phonology consists in advancing the articulatory processes toward the front of the mouth". See also Sweet (1906: 74), Ripman (1939: 99), Heffner (1964: 99), and Laver (1980:47)

On the subject of the overlapping of the three modal spheres, Delattre has noted that failure to pronounce a consonant with rounded lips when it precedes a rounded vowel inevitably results in diphthongization of that vowel (1953: 11). Yet diphthongization through failure to anticipate the vowel is adequately controlled by the *mode croissant*, for as Delattre (1951a: 57) notes, vocalic anticipation applies to *all* vowels and "les commissures des lèvres s'écartent avant l'explosion du -d- pour *dix*".

We have also noted the back *r* as a central aspect of the *mode antérieur*. In spite of its extremely backed point of constriction, Delattre (1951a: 61) has called this sound the "clef de l'antériorité", since it permits the tongue to retain its characteristic convex shape – another central aspect of anteriority. Yet here again, the relationships are sometimes confused; for in other writings, this tongue shape and the variety of *r* which it spawns are presented as results of anticipation of all vowels, both front and back (Delattre 1944d: 207).[23]

The importance of front resonance has also been mentioned in the production of a "French voice", that is, of some sort of overall general character of speech that makes it sound French. This would appear to be the thrust of those frequent references to anteriority among AS writers mentioned above. At the centre of this seems to be the front rounded series of vowels, whose

> ... caractère d'antériorité est doublement assuré, et par la position de la langue, et par celle des lèvres. Or ces deux qualités font rarement double emploi: normalement, les voyelles antérieures sont non-arrondies ... et les voyelles postérieures seules sont arrondies ... . (Delattre 1953: 11)

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[23] Similar statements are found in Delattre (1946b: 432, 433) and in Matte (1982: 136).

Elsewhere, these vowels are referred to as "la série la plus française" (Delattre 1951a: 59). Without broaching the issue of the rarity of the co-occurrence of fronting and rounding, we must note here that, on the basis of later research, Delattre (1964a: 88) states:

> ... in both French and German, those front-rounded vowels have a very low frequency of occurrence. They serve therefore much less than is generally assumed in characterizing the auditory impression of those languages ...

Furthermore, he reports a study (1963b:207-210) of syllable structure involving manipulations of transitions in synthetic speech. Here, the absence of closure transitions and the presence of a gradual vocalic onset made a sentence "sound clearly French" while the opposite configuration was identified as English-like. The point in all of this, then, is that, real and important as a "French voice" may be, it has its source in articulatory processes other than anteriority alone. If place of resonance does play a role in making speech "sound French", it is probable, as the following pages endeavour to show, that extreme *posteriority* is as salient a feature of "typical" French speech as extreme anteriority, and that there exists a more valuable resonance contrast between French and English than this one proposed by Delattre.

From what has preceded, then, we note that, beyond the high proportion of front articulations in French, the generally rounded form of the lips, and the dental articulation of apical consonants, there are no features that are clearly and necessarily related to anteriority.

On the question of statistical evidence, Matte (1982:142) lists as anterior segments in French the three semi-vowels, [j, w, ɥ],[24] as well as twelve consonants [p, b, m, f, v, t, d, n, s, z, ʃ, ʒ]. On the same page he cites research which found that "labials plus apicals comprise 73% of all consonant articulations".[25] Since here, comparative figures are not available, we must turn to a different study. Using Delattre's (1964c: 95) table of "Comparative Frequency of Occurrence of Consonants" and those consonants listed by Matte, we find that 60.29% of French consonantal articulations are apical or labial, as compared to 59.89% for English: certainly a negligible difference. If we include the semi-vowels, the figures rise to 66.64% for French and 65.57% for English: still not a meaningful divergence. Finally, if we add to those the occurrences of English affricates [tʃ, dʒ], which would reasonably be included along with [ʃ, ʒ], we find that front articulations comprise 72.66% of English consonants and only 66.64% of French consonants! These data certainly fail to demonstrate anterior articulation for French and posterior for English.

Statistical evidence in support of anteriority with regard to vowel systems is also available: on the basis of formant frequencies for vowels in English, German, Spanish and French, Delattre (1964a: 80) concludes:

> The vocalic system of English is *more open* (low) than those of the three target languages. Its close vowels are less close. Its center of gravity is lower. And its low vowels are more extreme ... than its high vowels, which is not the case with the target languages. ... If we call "back" vowels all those that are clearly to the right of center on the acoustic charts, the vocalic system of English appears as richer in

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[24] Once again, Matte's inclusion of [w] among front articulations is on the basis of its lip-rounding (cf. page 23, note 18 above). Our inclusion of the sound here is not to be interpreted as support for this classification; rather, we hope to show that, even if one adopts this artificial scheme, the available data on consonants fail to characterize English as less anterior than French.

[25] Matte cites Malécot (1974: 161).

back vowels than the three target languages.[26]

A few years later, however, data from syllable structure analysis lead Delattre and Olsen (1969: 164) to conclude: "The typical phonic impression left by English should be an apical with *strong central resonance* [emphasis added], ... French an apical with strong front resonance ... ."[27]

Similar confusion in the characterization of the English sound system is also found in Delattre's (1969b) comparative study of unstressed vowel reduction. Here, speaking of the "pole" on an acoustic triangle toward which unstressed vowels tend to gravitate in French, as compared to English, the author explains: "Being acoustically more to the left correlates with the well known tendency of French toward tongue fronting, which contrasts with the tendency of American English toward tongue backing." (p. 315) This comparison is made in spite of the fact that earlier in the same article, we read that "The overall pattern of English vowel-reduction ... is one of 'acoustic centering' toward a pole which is slightly higher and more front than center." (p. 312)

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[26] It would seem more appropriate to call "central vowels" all those that lie in the middle third of the triangle, since we allow for mid vowels where height is concerned. It should also be noted that this same article (p. 89) shows [ə] to be the most frequently occurring English vowel (22.99% of all vowel occurrences) by a considerable margin.

[27] Also worthy of note is that formant frequency data reported in this same year (Delattre 1969b: 303-304) for English and French stressed vowels no longer give clear support to the claim that the English vocalic system is "more open" than the French. When one plots the listed frequencies on acoustic triangles, superposition of one triangle upon the other shows only three English vowels lying beyond the periphery of the French triangle: English [ɔ] is clearly backed and lowered by comparison to its French counterpart; [æ] and [ɑ] are extreme in F2 frequencies, but not in F1 values.

It is shown, then, that frequency of occurrence data for consonants simply fail to demonstrate greater anteriority for French than for English. And while numbers for vowels may show French to have a high proportion of front articulations, they do not succeed in showing clearly that English is characterized by posterior articulation; from what has been shown so far, a label of "central articulation" is at least as accurate. If that is the case, then a meaningfully contrasting *mode* for purposes of phonetic correction may be based either on an English opposition to the anteriority of French, or on a French opposition to English centrality. There is no *a priori* reason for choosing one emphasis over the other; rather, meaningful contrasts must be selected on the basis of what articulatory skills the second language learner needs to develop, in order to improve his pronunciation. From this point of view, the development of anterior articulation (both from the point of view of tongue constriction and lip rounding) loses all of its importance, and indeed may become a counter-productive measure: fronting of French [u, o] would serve only to strengthen foreign accent, since English equivalents are already more fronted than they. The goal is not to lead learners to make a higher proportion of fronted sounds; rather, we must help them produce *all* sounds – front *and* back – with greater accuracy. The dangers are even greater with regard to lip articulation: for though it may be true that in French the lips are "generally rounded", rounding of [i, e, ɛ] would have disastrous effects on the French system of oppositions, which students are attempting to master. And though anteriority explains the vigour of French lip rounding which also means extreme projection, it fails to account for the apparently related articulatory habit according to which lip spreading is done with equal force and is accompanied by extreme "flattening" of the lips against the teeth (Delattre 1968: 55). In the end, if lip rounding in English is less strong than in French, so also is its lip spreading less strong.[28] For these vocalic features, an anterior-posterior contrast would appear to be far less productive than Matte's concept of centrifugal and centripetal articulation (cf. p. 20, above). It has been noted above (p. 31, note 27) that, according to this latter dichotomy, the fronting of English [æ], the backing of [ɑ], and the backing and lowering of [ɔ] remain unexplained. Yet, if, in the attempt to produce French [a], a learner produced a vowel which is sufficiently open, it is highly unlikely that fronting or backing will create problems, since the most accurate characterization of the French *a* sounds, with regard to fronting and backing is their wide variability (Delattre 1957, Mettas 1970, and Peretz 1977). Concerning the remaining vowel, classroom experience tells us that substitution by learners of English [ɔ] for its French counterpart is not particularly common; rather, the tendency in pronouncing *école* [ekɔl], for example, is to substitute either a diphthongized close vowel approaching [o], or centralized [ʌ]. Furthermore, in the error analyses conducted by Lebrun (1975) and Ragusich (1977), the overwhelming majority of dominant oral vowel errors (excluding diphthongization) involve closing of the low and low mid vowels, opening of the high and high mid vowels, backing of the front and fronting of the back – in short, some kind of centralizing tendency.

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[28] If extreme projection of the lips is to be taken as a sign of fronting, then drawing the lips back tightly against the teeth would logically relate to backing.

Moreover, if the notion of centrifugal articulation can be extended beyond vowels to include consonants, the dental articulation of French apical consonants, as contrasted with the alveolar articulation in English, can be accounted for by extremity of articulatory positions, and needs no appeal to a *mode antérieur.* Additionally, centrifugal articulation explains the extremely backed French *r* more naturally than does anteriority, and it accounts for the less high and less fronted articulation of English [j] in comparison to its French counterpart (Delattre and Delyfer 1970: 70). It is true that not all English-French consonantal comparisons fit neatly into a centrifugal-centripetal mold: the velars, for example, are nearly identical in the two languages,[29] and there exists no point of articulation that is more extremely fronted than that of the bilabials. Nonetheless, there are no articulations in English which are more centrifugal than their counterparts in French,[30] and it is highly doubtful that pronunciation errors would result from the mastering of the principle.

From the above, then, it can be concluded that the *mode antérieur*, an articulatory setting of low phonetic yield at the outset, finishes by having no phonetic yield upon closer scrutiny, and that the feature differences between English and French articulation fit more neatly within the spheres of the

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[29] It is worthy of note, however, that Crooks et al. (1943: 505-506) found a greater degree of palatalization of [k] in *iki* in the speech of four American subjects than in that of a single French subject.

[30] It might be suggested that the interdentals [θ, ð] constitute a real exception to this contrast of the two languages, yet, since French does not have those sounds, comparison is impossible.

modes tendu and *relâché* alone than they do in the spheres of the three modes. It must be underscored here that we are not attempting to discard all aspects of the *mode antérieur*: the habitually arched tongue shape may well be of central importance in the production of an accurate French accent,[31] but it fits well, from an intellectual point of view, under the *mode tendu*, since it demands palpably more effort than the low body position and retroflexed apex of English;[32] alternatively, as has been suggested (cf. p. 23, above), it may indeed be the result of vocalic anticipation and fall therefore within the sphere of the *mode croissant*. In all of this, of course, it is obvious that, in replacing anteriority with Matte's centrifugal articulation, we are dealing with no more than an intellectual construct (as indeed we are when speaking of any aspect of the modes at this point), and that ultimately, the place of individual features within a framework of articulatory settings must be established on empirical grounds. Yet it is hoped that the discussion has shown the centrifugal-centripetal contrast to be potentially more productive as an avenue of research, as well as more productive and less harmful as a pedagogical approach, than the *mode antérieur.* In the end, one might legitimately wonder whether Delattre and Matte have seen this mode as being on the same level as the other two, in spite of (or perhaps because of) their efforts to provide statistical support for the notion – that degree of support is never offered for the other two modes. In Matte's (1982) portrayal of the evolution of French from Latin, the first 135 pages of his 146-page analytical section pass without mention of the *mode antérieur* – the reader cannot fail to note that, in the overall scheme of the history of French, this mode is accorded far less importance than the other two. The irony of the situation is perhaps best shown in a statement in Klausenburger's (1984: 452) review of Matte's history: "A fifth mode, *antérieur*, is mentioned ... and seems to be of secondary importance, though of course it is a well-known feature of Modern French pronunciation."

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[31] In Delattre's two articles on pharyngeal sounds (1969a, and 1971b), tracings taken from motion picture X-rays would indicate the opposite of what has been said concerning tongue shape in English and French. While there are instances of tongue concavity in articulation of French *r*, there is no trace of retroflexion in English *r*. Nonetheless, since tracings are shown for only one occurrence of the sounds in each environment (perhaps from only one speaker for each language), it is doubtful whether the last word has been spoken on the subject.

[32] Honikman (1964: 79) notes that, in contrast to the French speaker, "the Englishman is not aware of any tension and *feels* the tongue to be relaxed [emphasis added]" – this in spite of the fact that, physiologically, she speaks of tongue tensing and laxing in *both* languages, but tensing and laxing of different muscles. As is mentioned below (p. 39), the tense/lax distinction may one day be shown to apply better to various articulator muscles *within* languages than to languages themselves.

The *Modes Tendu* and *Croissant*

In comparison to the *mode antérieur*, much less real clarification can be achieved by closer scrutiny of the *modes croissant* and *tendu.* At the definitional level, as was noted above, stability of articulatory states, rapid transition movements, syllabic equality, and lack of intonational "sliding" within syllables, and vocalic anticipation have all been connected to both of these latter modes. At the product level, we have noted the same for the French lack of diphthongization, affrication, palatalization, unstressed vowel reduction, consonant lenition, aspiration of initial voiceless occlusives, devoicing of voiced consonants, and diffusion of nasality. In the end, there is very little which clearly falls within the realm of one mode and not of the other. Matte's (1982: 138) statement provides an explanation for the apparent confusion:

> On parle de trois modes parce que cela facilite l'analyse. Mais, en réalité, le chevauchement de leurs effets est très fréquent, car les modes ne sont que les indices d'*une* tendance globale de la répartition de l'énergie articulatoire dans la chaîne parlée [emphasis added].

Moreover, in his portrayal of the evolution of the modes, Matte clearly presents the *mode tendu*, not as a controlling mode having an independent existence, but as a consequence of a governing *mode croissant*.[33] In this light, then, for the purposes of phonetic correction, it would seem most reasonable to treat the two modes as a single tendency comprising all the defining facets listed under both modes. It is conceivable that, one day, these facets may all be found to issue from an articulatory tendency to gradually increase the output of energy during the course of a syllable; however, at this point, since that has not been shown, and since some of those claimed results are said to have taken centuries to be realized, for pedagogical purposes it would seem prudent to retain a multi-faceted definition of the setting.

If such is to be the theoretical concept of the articulatory setting, it would be well to consider some of its central facets whose reality or pedagogical usefulness may be open to question.

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[33] Concerning the *mode relâché*, Matte (1982: 60) states: "Ce mode est à la fois l'aboutissement et le complément du mode décroissant." For more detail, see pages 91, 133.

The *Tense-Lax* Distinction

One of these facets must certainly be the principle of the tense-lax distinction, which has sparked a good deal of controversy. For example, in his review of Laver (1980), Nolan (1982: 450) offers the following criticism:

> ... the settings 'tense' and 'lax' refer to the overall tension of the vocal musculature. Acoustically, a tense setting will result in a source spectrum with more high-frequency energy, and in less damping of resonances in the vocal tract, giving rise to a 'metallic' auditory impression; the opposite is true of lax voice, which may be heard as 'muffled'. The articulators may also make more energetic excursions from a neutral position in tense voice. Laver quotes in support a number of writers who have used 'tense' and 'lax' as phonological terms; however, it is not clear that this strengthens his position when he takes no account of criticisms concerning the phonetic content of the labels thus used – notably those of Lass (1976: 39-50).

Nolan's criticism here fails to reach the target, however, for as he notes, Laver is speaking of *muscular* tension, while Lass (1976: 39-50) is arguing against the terms as they are applied to vowel pairs within languages ([u] : [ɷ], in English, for example). Within that same section (p. 43), Lass includes a statement which may be interpreted as tacit support for the distinction as applied to contrastive linguistics: "Certainly the whole muscular setting of the speech apparatus varies immensely from language to language; ..." Similarly, Delattre (1962: 133) cautions against the use of these labels in the characterization of vowels within a language and states that "the terms *lax* and *tense* should be reserved for the comparison of languages". Elsewhere, he stresses that, when he uses these terms, he is using them as *muscular* descriptions (1946a: 7). However, the precise parameters of the labels are advanced only tentatively:

> Some languages are said to be more tense, or more lax than others. What is probably meant is that the muscles of articulation are more contracted, and/or that more muscular energy is spent per unit of time or per sound. Obviously, such articulatory features are not easy to measure; no one, as far as we know, has yet found a way to do it. (1963b: 43)

Yet there is some subjective evidence, at least, for the distinction. Delattre has noted visible evidence of tenseness around the lips of French speakers, and of laxness in English speakers on motion pictures taken during the production of [e, o, i, u] (*ibid.*). Honikman (1964: 74-79) notes the same, as well as wider jaw opening, greater tongue visibility, and increased "drawing-in" of the cheeks in French speakers, as compared to English speakers. It has been suggested above (p. 35) that the arched tongue shape in French and the concave shape in English seem to fit well into the categories tenseness and laxness respectively.

Still, in spite of the fact that the distinction seems so accurate a characterization of French-English articulatory contrasts on an intuitive level, a good deal of additional work is required: as Matte (1982: 10, note 1) cautions, "le renforcement de l'activité musculaire d'un organe est presque toujours compensé par l'affaiblissement de celle d'un autre". In this light, the tense-lax distinction may ultimately have to be changed from a classification of languages to a classification of activities of various muscles within languages.[34] For example, Honikman (1964: 76-79) speaks of vertical tongue contracting and lateral laxing in French and the converse in English. For optimum pedagogical application, we need to know precisely which muscles are tensed and which are not. Additionally, a given aspect of muscular tenseness must be shown to have a real effect on phonetic production. Along these lines, though the realization of French vowels is certain to depend in part on vigourous lip rounding and spreading, the articulatory source of problems of voice onset timing is less clear: Delattre (1951a: 53) recommends glottal tension as an antidote to aspiration, while Matte (1982: 139) prefers diaphragm tension. Finally, a given aspect of muscular tension must be describable in easily understood terms. While vigourous lip activity is easily seen and mastered,[35] development of glottal tenseness virtually defies teaching.

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[34] Note that this idea would seem to fit well with Matte's division of roles among articulators (cf. page 20, above).

Clearly, our inability to measure tenseness constitutes a serious problem in the use of the term for explanation of linguistic phenomena, yet it need not render the concepts useless in phonetic correction. For, provided that a perceived aspect of tenseness or laxness is found to be salient in terms of its influence on phonetic product, the pedagogical usefulness of that aspect depends only on its being describable and teachable, not necessarily on its being measurable.

Open vs. Closed Syllables

In his little manual of corrective phonetics, Delattre (1951a: 39-40) presents a series of exercises in which open syllable structure is absolutely maintained. For example, he recommends saying the word *parti* as [pa-rti], though he admits that this is an exaggeration adopted for corrective purposes, and that in reality, the syllable break falls in the course of the articulation of the *r*. The practice of exaggerating, here, is quite understandable, if the corresponding description of "reality" is found to be accurate. However, the importance attributed to the distinction between open and closed syllables in the theory of the modes appears problematic in light of Ladefoged's (1982: 219) statement that "there is no agreed phonetic definition of a syllable". For Delattre (1951a: 18), the definition is as follows:

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[35] The movement is easily mastered in isolated utterances when attention is given to it; on the other hand, the articulatory *habit* is far more difficult to develop.

> Du point de vue articulatoire, la syllabe est la portion de la chaîne parlée comprise entre deux minimums de tension musculaire. ... Pour passer d'une syllabe à une autre, il faut donc qu'une tension décroissante soit suivie d'une tension croissante. Le point minimum de la tension – celui où elle change de sens – s'appelle le point de "coupe syllabique".

In his (1944b) study of French syllable division, he dresses a list of words in which the juxtaposition of sounds of all combinations of aperture degrees are contained. He notes that in all types of consonant clusters, the syllabic break occurs *during the course of the first consonant*, and he states (p. 165) that experimentation verifies his conclusions. Though one may assume this experimentation dealt with some sort of attempt to apply mathematically the above definition,[36] it must be noted with regret that the author chose to omit "les renseignements techniques" (p. 164). As a consequence, we are left with no indication of the real-world correlates of this syllable break in French or of the English syllable break, as compared to the French, mentioned in the following (1944c: 374) comment: "En anglais, l'anticipation consonantique fait que la coupe syllabique se produit beaucoup plus près de la fin du groupe [de consonnes]." In later cross-language studies of syllable structure and length, while still maintaining a "scientific" definition of syllable break (1966d: 184), he conducts his analysis on the basis of De Saussure's (1931) principles.[37] Therefore, if Delattre ever applied a measurable definition of the syllable, he did not pass his procedures on to us; and as long as we remain without such a definition, firm statements with regard to cross-language differences in syllabic structure must be viewed with a certain degree of skepticism.

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[36] Since, more than a decade before the publication of his manual on corrective phonetics, he was already offering a similar definition of syllable division (1940c: 158, note 18), we might assume that in this (1944b) study, that definition was still being held.

In addition to the above, there is some evidence which may be seen to militate against the notion of French separation of vowels from following consonants. One of these pieces of evidence is the French shortening or lengthening of vowels by following consonants, which Delattre (1940b: 122-123; 1965b: 78) sees as anticipation, during the course of a vowel, of greater or lesser effort in the consonantal articulation to follow. Another is the well-known *Loi de Position*, according to which mid-vowels tend to be realized as higher in open syllable, and as lower in closed syllable.[38] Neither of these two phenomena should exist, if French vowels truly remain free of the influence of following consonants. Yet, additional consideration of the latter may shed some light on the question. In his study of the role of the word in French phonology, Rochet (1977: 192) notes the low-mid pronunciation of the second vowel in *je cède à mon frère*, and offers this comment:

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[37] See Delattre (1963b: 39) and (1966d: 185), as well as Delattre and Olsen (1969: 160).

[38] This law, applied virtually without exception in dialects of southern French (Rochet, 1982), is weakened to a tendency in standard French. For an overview, see Valdman (1972).

> Thus this short sentence can either be represented as [žə-sɛ-da-mõ-frɛr] in which case the Law of Position does not apply, and this seems to be due to the presence of a word boundary; or as [žə-sɛd-a-mõ-frɛr] and postulate a syllabic cut which is contrary to the rules of syllabation as they have generally been formulated for French, but coincides with a word boundary.

Since it seems almost as difficult to ignore those syllabation rules as it is to ignore the Law of Position – or vowel shortening and lengthening, for that matter – it is not inconceivable that we might want to posit different sets of rules for syllable division, one functioning at a more concrete level than the other.[39]

There is some support for a French-English difference which is describable along those lines laid out in the mode theory. Delattre (1963c) shows evidence – acoustic, cinematographic, and cineradiographic – in vowel articulations which leads him to conclude (p. 76): "L'attaque de ces voyelles est plus forte et l'énergie plus décroissante en anglais qu'en français, où l'intensité est parfois même croissante." Furthermore, a consonant-vowel anticipation distinction seems quite appropriate in accounting for differences in lip positions for consonants before rounded vowels (Delattre 1964c: 107); for perceptual judgements made on the basis of differing formant transitions in synthesized speech (Delattre 1963b: 36-37); and for articulatory and acoustic differences in the production of prevocalic [j], and of oral vowel before nasal consonant (Delattre and Delyfer 1970). Finally, in an analysis of 2000 syllables from both French and English speech, Delattre and Olsen (1969) found that about 60% of English syllables were checked, while the corresponding proportion in French was 24%. Though, as was mentioned above (p. 42), the syllable cuts were made on the basis of De Saussure's theoretical principles, it is likely that these have enough correspondence to reality for us to see in the figures a real difference between French and English syllabic structures. It would seem rather foolhardy, then, to discard the notion in its totality, simply for lack of an agreed-upon definition of a syllable. For purposes of linguistic analysis, it may be preferable to adopt terms such as "increasing energy" and "anticipation".[40] For pedagogical purposes, on the other hand, it would probably be wise to retain explanations and exercises presented in terms of "open syllabification", since the concept is considerably simpler than the alternatives suggested above.[41]

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[39] For an analogous, though not identical proposal, see Matte's (1982: 36-38) distinction between *syllabisation* and *syllabation*.

Syllabic Equality

With regard to the notion of syllabic equality, Delattre (1951a: 43) writes: "L'égalité syllabique a fait comparer le rythme du français aux perles d'un collier, aux grains d'un chapelet, aux battements du coeur, etc." As we look for the existence in reality of this syllabic equality, it is perhaps in order to mention some research that has recently been conducted on the tneory of stress-timing and syllable-timing. Faber (1986: 207) summarizes:

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[40] It should be noted that Delattre (1948a: 376) equates "open syllabication" with "less consonant anticipation in the transitions vowel–consonant, and more vowel anticipation in the transitions consonant–vowel". At least on this one occasion, then, he has taken away any need to define *syllable*.

[41] See, for example, the script of the instruction used for our experiment (Appendix I).

> The theory holds that in every language there is either a dominant tendency to make interstress intervals equal, in which case syllable-lengths will be decreased or increased according to whether there are more or fewer syllables between stresses, or there is a dominant tendency to keep syllable-lengths equal, in which case the duration of an interstress interval will have to be directly proportionate to the number of syllables it contains.

Proponents of this theory consider English as an example of stress-timing, while French is held to remain "the unchallenged example of a 'syllable-timed' language" (Wenk and Wioland 1982: 193). Among the researchers who have set out to test the theory,[42] Wenk and Wioland (1982) and Reeve (1984), among others, have failed to find evidence for syllable isochrony in French. In light of the above comment from Delattre, one might be tempted to dismiss the notion of syllabic equality and to look elsewhere for a meaningful set of contrasting articulatory settings for French and English. Yet the pedagogically motivated imagery of that statement presents an oversimplification of what Delattre believed to be true; immediately preceding it (1951a: 43) we read: "Les syllabes sont perçues comme égales parce qu'elles ont toutes à peu près même force (intensité), et toutes à peu près même durée *sauf la dernière* [emphasis added]." However, having different theoretical interests, neither of the above-cited studies has tested the type of equality which Delattre had in mind – namely, equality in intensity of all syllables and equality in duration of *unstressed* syllables only. Wenk and Wioland (1982) retain both stressed and unstressed syllables in their measures. Reeve (1984: 45-48) does isolate the group-initial unstressed vowel, but its length is compared to that of other initial unstressed vowels in other groups of different types, instead of with vowels of other unstressed syllables within the same group. As is noted by Matte (1982: 62), within the theory of the modes, the notion of syllabic equality functions "au niveau du groupe rythmique". These researchers, then, have carried out valuable work with regard to the theory of syllable- and stress-timing and have found that theory wanting.[43] However, for those of us who are interested in the linguistic reality of aspects of the modes, it is necessary to look elsewhere, for they have not addressed *this notion* of syllabic equality.[44]

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[42] See Reeve (1984) for a survey of this research.

Matte (1982: 62) offers evidence in the form of means from which he concludes:

> Il ressort de ces calculs, que toutes les syllabes atones sont à peu près de la même longueur sauf la première, la syllabe initiale de groupe, et la dernière, la syllabe tonique. D'autre part, ... la syllabe initiale est un peu plus intense que les autres voyelles atones; ce qui

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[43] Faber (1986: 209) reaches the conclusion that "... it now seems most likely that this [stress-timing / syllable-timing] typology represents nothing more than a subjective impression of rhythmic difference between languages, without giving any precise indication of just how they differ." It is worthy of note that failure to corroborate the syllable-timing theory comes as no surprise to Wioland and Wenk (1982: 201) who cite Delattre's (1966d: 189) finding that French tonic syllables showed *wider* divergence in length from atonic syllables (78% longer on an average) than did those of any of the other three languages investigated. See also p. 203, where Wioland and Wenk argue that to assume syllable-timing for French is "to imply that French is not fully a language".

[44] Note, however, the similarities between the *trailer-timing/leader-timing* theory suggested by Wioland and Wenk (1982) and aspects of the *modes* discussed above.

rachète son manque de longueur.

Similarly, Delattre (1966d) shows tables of means comparing various syllable lengths in four languages. He concludes with a graphic illustration (p. 197) showing perfect equality in duration and in intensity for French unstressed syllables as well as for English non-final unstressed syllables; English final unstressed syllables are shown with equal intensity and with approximately 75% greater length. However, he stops short of presenting comparisons of atonic syllables within languages and, consequently, fails to provide the numerical data on which his graph is based. The problem with the evidence provided in both of the above is that means fail to allow us to conclude anything about the relative syllabic equality of one language in comparison to another. What we need is some sort of measurement of divergence from equality. In the apparent absence of that, it was undertaken to look at spectrograms of a small sample of polysyllabic words from our corpus. These were made for the words *automatique, photographie,* and *protestant* as said by the native speaker of French who provided the stimulus for the test recording and by nine of our English learners of French on the pretest. Measures were taken of the intensity peak and of the duration of each of the atonic vowels.[45] In order to arrive at some kind of value of the divergence of atonic syllables from equality, a ratio of greatest over smallest was obtained,[46] both for duration and intensity. For the

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[45] A measure of vowel duration, rather than of syllable duration, was chosen on the basis of Delattre's (1951a: 45) claim: "... le seul élément physique qui soit toujours en excès dans la syllabe accentuée est la durée. C'est la voyelle surtout qui reçoit ce supplément de durée."

[46] See the use of the ratio in Fry's (1972: 203) procedure.

French speaker, the longest atonic vowels lasted, on an average, 30% longer than the shortest, while for the nine English-speaking subjects, they were 110% longer; only 1 of the nine subjects managed to match the level of equality shown by the model. With regard to intensity, the divergences are less pronounced, but still quite revealing: the strongest atonic syllables were 20% more intense than the weakest for the French model, 40% more intense for the subjects. Once again, only one English speaker duplicated the level of equality of the model. Given the small sample of words, and given the fact that there was only one native speaker of French, finding statistical significance for the difference is out of the question. Nonetheless, in the absence of better data, the above may serve to provide some hope for eventual empirical support for the long-standing subjective impression of syllabic equality in French. From a pedagogical point of view, it would seem to be a relatively easy notion to teach, if one applies Delattre's (1951a: 43) recommendation to articulate a five-syllable word, as if one were counting to five.[47]

Finally, then, though controversy surrounds the notions of tense/lax articulation, open/closed syllables, and rhythmic equality, it would seem unwise at this point to discard them. As has been noted, terms and emphases may have to be changed. Additionally, in order to be useful, the notions of muscular tenseness and laxness will have to be expressed in terms which are far more precise. But there is at least some support for the linguistic reality of these three distinctions and for their just placement within the overall theory of the modes. With regard to this broader concept, some alterations have been suggested – notably the elimination of the *mode antérieur* from the theoretical framework on the basis of its low productivity and its potentially harmful effects in the pedagogy of phonetic correction. Also to be recommended is the elimination of the artificial distinction between the *modes croissant* and *décroissant* on the one hand, and the *modes tendu* and *relâché* on the other; for the literature shows far more shared elements between the two than distinct ones; and though central aspects of those modes are said to be closely related, at this point there would seem to be no reason, theoretical or empirical, for uniting them. For the time being then, a new, tentative representation of contrastive articulatory settings for French and English may take the following shape:

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[47] See the application of this in our experiment instruction (Appendix I).

French	English
tense articulation	lax articulation
centrifugal articulation	centripetal articulation[48]
open syllabification	closed syllabification
rhythmic equality	rhythmic inequality
convex tongue shape	concave tongue shape

Needless to say, as new empirical evidence sheds light on aspects of the theory, reorganization could be done. Ultimately, as Matte (1982: 138) has suggested, it might be shown that those aspects which are presently shown as causal, or productive, articulatory settings are really the consequence of a single, overriding mode. In the absence of evidence for that, however, it would appear premature to propose that degree of simplification.

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[48] This distinction would include – or may even be replaced by – the differences in roles of various articulators as suggested by Matte (cf. p. 20, note 16, above). From a pedagogical view, however, it would seem preferable to retain both contrasts as aspects of the same cross-language difference.

V. APPLICATION AND RESEARCH

The theory of the modes as contrasting articulatory settings for French and English is obviously interesting to the descriptive linguist and the applied linguist alike; it also holds great potential interest for the language teacher who uses articulatory description as a means of improving pronunciation accuracy. For while some phonetic features are quite easily explained to students, others are painfully elusive. The hope which the mode theory holds for us is that if we are able to help students alter their global speech patterns by providing understandable description of some speech articulations, or of the generalizations, we may also find that they can improve their pronunciation of less easily describable elements with no cognitive instruction relating specifically to those elements. We might hope, in effect, that some phonetic correction will be *concomitant* with other correction.

If such concomitant improvement could be shown to occur, then the pedagogical usefulness of Delattre's modes would be greatly increased. Not only would they serve as a theoretical framework on which to organize phonetic details, but perhaps they could also eventually suggest the syllabus for the course in corrective French phonetics for English speakers – i.e. they could specify the *content* (what we must teach and what we need not teach), as well as the *ordering* of the elements of that content (what skills must be mastered early in order to make subsequent instruction most effective). This, of course, would apply only to those difficulties which can be shown to relate to the modes. As was mentioned earlier, Delattre claims to explain *all* the phonetic difficulties of French pronunciation within the framework of the modes; on a purely cognitive level, everything fits in nicely indeed. Research may show, however, that some of the pronunciation difficulties of English-speaking learners of French find their place within the framework of the modes only on the cognitive level, and that they do not submit to the governance of the modes on the level of linguistic reality. The place of these phonetic difficulties in the syllabus and the plan for their instruction would have to be motivated by other principles. However, if the consequences of the modes are as far-reaching as Delattre and Matte have suggested, such exceptions would be few.

Before consideration of research which has been done up to the present, it should be noted that the theory is currently finding application in the teaching of pronunciation. Without necessarily mentioning the terms "articulatory settings" or "modes", writers of instructional materials for phonetic correction use the concepts in their explanations. Kelz (1971: 205-207) lists a number of quotes taken from pedagogical publications. As a further example, which is related specifically to notions contained in the modes, consider the following from Valdman et al. (1970: 37):

> In English, syllables differ with regard to stress; some sound much louder than others ... In French, however, all syllables are produced with equal stress, and usually no syllable stands out in an utterance. ... Note that unstressed vowels in English are usually pronounced /ə/ but that in French the quality of the first or second vowel is quite constant. In English, the unstressed vowels are of the weak variety, and whenever the stress on an English vowel is reduced, its quality will become neutralized to /ə/.

Along the same lines, note the importance accorded to open syllabification by

Léon and Léon (1964: 60).

In addition to being used in pedagogy, elements of the modes are finding application in the explanation of variants in error analyses. In accounting for the most commonly found generalized errors in her study, Lebrun (1975) explains aspiration of voiceless occlusives by appealing to lack of vocalic anticipation (p. 192); intrusive nasal consonant is held to be the result of lack of tension and of consonantal anticipation (pp. 209-210). Likewise, in Ragusich (1977: 51-52), undue opening and closing of vowels is ascribed to lack of muscular tension.

From the few examples cited, one notes that, both in the realm of pedagogy and in the realm of phonetic analysis, articulatory settings – the modes in particular – are held to have an articulatory reality. In that light, it would be well to look at what empirical research has shown us concerning that reality. By far the greatest amount of research conducted on articulatory settings up to this point is to be found in the work of Pierre Delattre. His attention to phonetic minutiae and his ability to relate them to broad generalizations have shed a good deal of light onto our understanding of differences in English, French, Spanish and German speech. Through his three-pronged approach of working with motion pictures, acoustical data, and synthetic speech, he has shown how differences in articulation of speech relate to differences in the physics of speech, and how they in turn relate to perception. A good deal of this contrastive work has already been mentioned.

Beyond Delattre's work, however, only one other similar study has come to our attention. Homiedan (1984) has found through analysis of palatographic data that points of tongue anchorage in English are significantly different from those in Arabic. On the basis of his findings, this researcher writes (p. 106) that "it is justifiable to state that any change in the location of the anchorage of a given language would alter the sound system of that language". Later, he suggests pedagogical applications of the notion, among which is the following (p. 107): "The best we can hope for, is that the teacher would correct a student when a faulty pronunciation occurs, emphasizing our new parameter which is the "tongue anchorage".

It must be noted here that there is a vast difference between the various possible levels of application of articulatory settings to the pedagogy of correction. On one hand there is a setting proposed as an intellectual construct which will aid the learner in the cognitive retention of the phonetic details he must master. Such seems to be, at least in part, the approach taken by Delattre (1951a), who provides a theoretical explanation based on his modes for each phonetic difficulty, and then offers a series of "*conseils pratiques*" as aids in correction, some of which have no connection with the theoretical explanation.[49] Much different is the use of settings in accounting for and correcting errors which have been made. This becomes especially noticeable in Homiedan's comment, according to which any undefined faulty pronunciation is corrected by an appeal to a single setting. Though the difference between tongue anchorage in English and Arabic is probably a very important one in terms of its phonetic consequences, there are no doubt some phonetic difficulties for Arabic students learning English which have nothing to do with that particular setting. Correction advice must be offered on the basis of the source of the error, insofar as that can be determined. So while the use of a setting as an intellectual construct may be simply good pedagogical strategy, whether or not that construct is related to the feature at hand in reality, appeal to settings in error analysis and correction requires some sort of empirical basis for the relationship. That is: Is it true, as Matte (1982: 43) has claimed, that "les modes d'articulation changent et les éléments de la chaîne s'y accommodent presque simultanément"? Does it indeed happen that change in one feature of phonetic behaviour is accompanied by concomitant change in another feature?

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[49] See, for example his treatment of aspiration (pp. 53-54).

It appears that there has been very little experimentation on this important question. Only two attempts have come to our attention. Thomas (1984) speaks of some success in automating the teaching of French pronunciation using Delattre's modes, and of disappointment in teaching English pronunciation to French students by reversing the procedure. It seems, however, that the specifics of these attempts have not been published. In Ozga (1976: 72) we read that K. M. Kolosov reports ...

> ... highly successful results in the teaching of the pronunciation of German to Russian schoolchildren on the basis of an experiment in which a group of learners who had some training in German articulatory settings acquired greater phonetic accuracy and naturalness than a control group taught by standard auditory and postural methods.[50]

Once again, it is unfortunate that details of this study are not available to us.

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[50] Kolosov, K. M. (1971)
"O roli artikulac'ionnoy bazy v obučenii proiznošyeniu", *Inostrannye jazyki v škole*, 5: 38-45.

There is some anecdotal evidence which might lead us to believe that concomitant change occurs. For example, Young and Choquette (1965) set out to test the relative effectiveness of four different types of language laboratory equipment. On the first day, before the initial pronunciation aptitude test, the subjects were given an introduction to the fact that sounds differ between languages, illustrated by differences between French and American [o] and [r]. "These instructions were given to prevent naive Americanization of the French pronunciation in the Aptitude Test so that it might be a test of the student's best mimicry prior to actual training." (p. 26) Following six instruction and training sessions, their subjects were tested on their pronunciation of the French sounds [o, y, ɛ̃, õ, l, t], as well as on their overall pronunciation of French sentences. The authors stress the importance of classroom instruction sessions in bringing about the pronunciation improvement that the subjects of their experiment showed (pp. 44-45). What is noteworthy in this is the content of that instruction:

> Classroom sessions began with general instructions aimed to impress the subjects with the essential differences between American and French speakers in the posture and action of the vocal muscles. No special instruction was given on the target phonemes for the day, and, indeed, there was little special instruction on any individual phonemes; ... . (p. 27)

No additional specification of those differences in "posture and action of the vocal muscles" is offered, but it is clearly some sort of instruction in articulatory settings which the authors are claiming to have been instrumental in bringing about improvement in the pronunciation of specific sounds.

Henning (1966) conducted an experiment with English-speaking subjects who had had no previous experience with French to test the relative value of auditory discrimination training with English-French pairs, guided practice in the mimicry of French monosyllables, and a combination of the two. With regard to the production portion of the experiment, he notes that, unlike the results found for pronunciation of some of the other French sounds tested, the three groups did not differ significantly in their avoidance of nasalization of vowels before nasal consonants – the pronunciation of all three groups was rated high for this feature. The author suggests the following (p. 16):

> A possible explanation may lie in the fact that the F [French] / n / of these sequences as recorded on the tapes by the native speaker was quite clearly released. The subjects might therefore have interpreted the vocalic element of the release as a vowel and reacted to the stimulus as though it contained two syllables with a CVCV pattern. ... Had the sequences been recorded with a less definite release, the results might have been quite different.

Though it is, of course, impossible to be sure, it is tempting to guess that the release of [n] was not exaggerated and that, had the release been less clear, it might well have been less French. Delattre (1951a: 64) recommends strong release of final consonant, and would predict less nasalization as a result of open syllabification (p. 42).

Additionally, mention should be made of two other articles. Subjects in Brière's (1963) experiment, while concentrating on a maximum of three target phonemes, showed "general improvement of articulatory skills *throughout the entire* [French] *system*" (p. 37). Honikman (1964: 81-82) notes improvement in pronunciation of segments when students get into a French or English "gear" – the term she used in teaching to refer to the appropriate setting which she had delineated.

In none of the above citations is there any information which would permit us to make firm conclusions with regard to the question of concomitant improvement. Yet all give indication that there may be such a phenomenon. It certainly merits some study. The general lack of research into this question may be due, in part, to the fact that the modes seem so appropriate on an intuitive level. Nonetheless, with their full force, they do claim that a large number of specific articulatory features will be changed as a result of change in general or global habits. A claim with such far-reaching consequences should not be accepted as self-evident – it begs experimental corroboration. What is called for, as a complement to the type of understanding of language differences provided by Delattre and Homiedan, is information concerning correlations between changes in one aspect of phonetic behaviour and changes in another.

VI. THE EXPERIMENT

Design and Hypotheses

In order to test the notion of concomitant phonetic correction, one must endeavour to cause pronunciation improvement to occur with regard to certain features and then to see whether there is correlated improvement with regard to other features. Among those French-English contrasts listed under our reorganization of Delattre's modes on page 49, it was judged that the two concepts most teachable to learners of French were open syllabification and equal syllabification. As has been mentioned, the former is a definitional aspect of the *mode croissant* and figures in our own reorganization. This feature was chosen to figure in the instructional content, but not as a category in the evaluation, since we were insufficiently confident of being able to make unequivocal judgements on syllabic openness in all environments. The latter feature – rhythmic equality – is held to be a central correlate of tense articulation (Delattre 1953: 9-10; Matte 1976: 469, and 1982: 64), but has also been related to open syllabification (Matte 1982: 38). This was taught and evaluated. In addition, it was decided to teach explicitly the clear release of final consonants. Though this feature is seen to be a natural consequence of open syllabification (cf. p. 23, above), and though such a connection seems appropriate on an intellectual level, it was judged prudent to include it in the instruction: since it is the only theoretical correlate of open syllabification which we deemed able to be accurately evaluated, significant pretest-posttest improvement in this phonetic behaviour was necessary for our analysis. It was decided to instruct and train the release of final consonant in terms of only two consonants: one occlusive [p], and one continuant [n]. However, subjects' realization of final consonant release would be scored for these two consonants, as a taught category, as well as for [m], [l] and the remaining occlusives as an untaught category. The point of interest here was to see how transfer of training and instruction would be effected to the pronunciation of unmentioned consonants.

Among the other features selected to be scored, but not taught, was unstressed vowel centralization: the maintaining of near-cardinal timbre of atonic vowels is the claimed result of articulatory tension and is directly related to rhythmic equality (Matte 1976: 469; 1982: 63-64). Predictably, though, in light of the connection of rhythmic equality with open syllabification, this centralization is also connected to the *mode croissant* (Matte 1982: 63). A second untaught feature to be scored was diphthongization. Avoidance of this is held to be a product of tense articulation by Matte (1982: 64), and as a product of open syllabification (pp. 38-39). Additionally, we measured aspiration of initial voiceless occlusives, which is related to articulatory laxing (Delattre 1951a: 53) and to vocalic anticipation (Delattre 1953: 12), the process at the heart of the *mode croissant*.

A final untaught feature chosen for consideration is height or closeness of post-vocalic final [j] as in *paille* [paj]. Since this phonetic difficulty has not been mentioned up to this point – it has not been specifically treated by Delattre or Matte – its inclusion here requires some additional clarification. In a chapter entitled "La Tension des semi-voyelles" Delattre (1951a: 65) states that "la semi-voyelle / j / est nettement plus brève et plus consonantique en français qu'en anglais". His discussion is limited to *yod* falling between consonant and vowel. However, as is noted by Valdman et al. (1970: 218), the same can be said for word-final *yod*:

> In final position, English / y / [i.e. *yod*] functions as part of a vocalic unit (as in *buy*, *bay*, *be*, *boy*) and is much laxer than its consonantal French near equivalent. In all positions in which it occurs, French / j / is shorter and produced with greater articulatory tension than English / j /.

Rochet (1983b: 230) clarifies what is involved in this greater tension:

> In final position, a tense articulation should entail a clear release ... Whereas in English diphthongs the vowel trails off gradually into a closer position, in French, the passage between the vowel and the semi-vowel is abrupt and [j] articulated with the tongue in a higher position than in English.[51]

As is the case with the other untaught features under consideration here, the articulatory height of [j] should have a dual theoretical connection to the other elements of the study. Insofar as rhythmic equality is a correlate of articulatory tension, improvement in this should result in concomitant improvement in *yod* timbre through the process of increasing centrifugality of articulation (cf. page 20, above). Additionally, Matte (1976: 470, 472) attributes the production of falling diphthongs to closed syllabification and, in his history of French, presents open syllabification as responsible for the Middle French simplification of Gallo-Romance falling diphthongs. Insofar as a tendency toward open syllabification militates against the production of falling diphthongs, then, under this articulatory setting, the glide element of *paille*, for example, should be accurately reinterpreted as a consonant. As a final consonant, it should be given a clear release and should become more close.

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[51] It should be noted here that Rochet's characterization of the difference between French and English [j] has been shown experimentally to apply to this semi-vowel in post-consonantal, pre-vocalic environment by Delattre and Delyfer (1970). In addition to greater tongue raising, these researchers also found increased tongue fronting in French (p. 70).

For the experiment, then, we evaluated subjects' production of this word-final [j] both in terms of its release and its height. However, since, unlike the case of other final consonants, we are dealing here with not only a different treatment of a sound, but also with its transformation from a vocalic element to a consonant, it was decided to keep release of [j] as a category on its own, separate from that of other final consonants.

To summarize the above, subjects were instructed in, but not evaluated on the principle of open syllabification. We taught and scored rhythmic equality and release of final [p, n]. Finally, scores were obtained, though instruction and practice were not given, on unstressed vowel centralization, aspiration of voiceless occlusives, diphthongization, release of word-final [j], and height of constriction of word-final [j]. An additional feature, scored but not taught, was release of final consonants other than [p, n].

The objective of the study, then, is to examine the degree of association between improvement with regard to taught features and improvement with regard to untaught features. This would provide an idea of the extent to which improvement in the untaught can be said to be *concomitant* with improvement in the the taught. From this point of view, the final feature – release of untaught consonants – may be somewhat ambivalent in nature: though the general principle was taught, instruction and practice were not presented specifically in terms of these consonants. The same might be said concerning release of final *yod*, though here, we are dealing with an added complicating factor in that the closing movement may be interpreted as vocalic rather than consonantal. There is interest, therefore, in observing the degree of association between these two features and release of taught consonants, since they are facets of the same principle. On the other hand, it may be that no such comparison of these two features with the other taught feature, rhythmic equality, is possible. For if one or the other of these features is found to relate to taught consonant release, that relationship must be given analytical priority due to its place within the generality of consonant release. In that case, any association found to obtain between that feature and rhythmic equality becomes meaningless, since scores from both categories would carry the contaminant effects of instruction and practice; no improvement with regard to release could truly be said to be concomitant. Because of this analytical priority of the relationships between these two features and taught consonant release, if those relationships were found to fail to reach significance, subsequent correlations between these features and that of rhythmic equality would have to be performed as *post hoc* analyses.

On the basis of the above, the following hypothesis can be formulated:

1. Since release of *yod* and of other consonants not treated in the instruction and practice are facets of the general principle treated in the instruction and practice with regard to release of [p, n], there will be a significant positive correlation between subjects' pretest-to-posttest

improvement scores in these untaught features and their improvement scores in the taught release of final [p, n].

The untaught features, centralization of unstressed vowels, aspiration of initial voiceless occlusives, and diphthongization have been related to both articulatory tenseness and open syllabification. The remaining untaught feature, height of constriction of [j] is relatable to both of those articulatory settings. In addition, as has been mentioned, Matte (1982: 138) claims that articulatory tenseness and open syllabification are simply analytically convenient indices of a single global tendency. On the basis of these, we can make the following grouped hypotheses which involve the above 4 untaught features, but which exclude untaught consonant release and *yod* release:

2. Since rhythmic equality is held to be a correlate of articulatory tenseness, there will be a significant positive correlation between subjects' pretest-to-posttest improvement scores in this feature and their improvement scores in each of the untaught features held to be characteristic of the *mode tendu.*
3. Since final consonant release is held to be a correlate of open syllabification, there will be a significant positive correlation between subjects' pretest-to-posttest improvement scores in this feature and their improvement scores in each of the untaught features held to be characteristic of open syllabification.

Subjects

The experiment was conducted within the context of a beginning French course at Concordia College, Edmonton, Alberta. There were two sections of the class from which to select subjects. Though the activities for the experiment were included as an integral part of the pronunciation component of the course and, consequently, were open for all students to participate in, not all students' results were included in the experiment. Excluded from the beginning were those who had speech impediments, foreign accents in their English speech, and native-sounding French Canadian accents in their French. Still others were excluded during the course of the study on the basis of their absence from one of the two testing sessions, or from the instruction session. Finally, three others were dropped from consideration during the course of test evaluation, when it was found that they had made almost no errors on the pretest. There remained then, as subjects, 26 native speakers of North American English – 13 males, 13 females – ranging in age from 17 to 49 years (mean: 20 years). Of these, 8 had had one year of study of a language other than French or English; one other subject had had three years of study of German, but a good number of years had elapsed since that time, and it was judged that the inclusion of this subject was not likely to introduce confounding results into the study. Though, as has been noted, the subjects were taking beginning French, not all were beginners. Admission to the Faculty of Arts required completion either of the final year of a high school second language programme, or of a beginning language course at the university level.

Consequently, though 7 subjects had not studied French previously, the remainder had had from 1 to 7 years of study beforehand; the mean of all subjects was 2.5 years of study prior to their enrollment in this course. The experiment spanned about two weeks in the beginning of November; therefore, all subjects had had a minimum of about 35 hours of French instruction before the pretest.[52] Included in this prior instruction was a unit on French Sound-Spelling Correspondences in which graphemes were related to symbols of the International Phonetic Alphabet. These in turn were related to English near-equivalents of French sounds, except in those cases where such near equivalents do not exist (the front rounded vowels, for example).

Instruction and Testing

One week after subjects were given a brief introduction to the experiment, including a calendar of events, all took a pretest, in which they were asked to mimic the pronunciation presented on tape of isolated words and a few phrases comprising a single rhythmic group.[53] In order to avoid problems caused by lack of readiness at the start of the test and by anticipation of the completion, three words which would not be scored were added to the beginning and to the end of the test. During the testing session, each student had a copy of the test to read from.[54] For each item, then, there was a three-way stimulus: in addition to the oral presentation on tape, they had a visual representation both in the form of conventional French orthography and a phonetic transcription. This was an attempt to reduce the number of spurious pronunciations, such as substitutions of [d] for [t], and the like. The tape for the test was recorded in a sound-isolated room with stimuli provided by a native speaker of European French. His realization of the test items was natural and showed no trace of artificial hypercorrection. The word or phrase was pronounced twice on tape with a pause after each. Subjects were asked to try to form an acoustic image of the word during the first pause, and to repeat it during the second. The testing was conducted in the language laboratory at Concordia College.

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[52] It was thought that this group of subjects provided a good opportunity for studying correlations between pronunciation performance and other variables. However, no significant relationships were found between subject scores and either sex or amount of previous study of French. Age could not be considered since, in spite of the wide range reported, almost all subjects were between 18 and 22 years.

[53] A complete copy of the test is attached as Appendix II.

Two days following the administration of the pretest, the subjects attended the instruction session. The content of that instruction has been summarized above in "Design and Hypotheses". The presentation of the lesson, done in standard lecture format with illustrations being projected from overhead transparencies, lasted about 30 minutes. Following this, subjects were each given for further study a copy of the instruction they had just heard, along with the printed text of practice exercises;[55] the group then proceeded to the language laboratory to do those exercises.

The taped presentation was recorded by the same native speaker of

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[54] Since the posttest was identical to the pretest, these were collected at the end of the session so that no practice could be done on the test words.

[55] A complete copy of the instruction and exercises is attached as Appendix I.

French who had done the test; once again, the subjects had, in addition to the oral stimulus, representations of the words in conventional orthography and in phonetic transcriptions. The format of the exercises was somewhat different from that of the test. In the first exercise, involving polysyllabic words, the first stimulus for each item presented the word broken up into separated equal and open syllables: e.g. *syllabation* [si – la – ba – **sjɔ̃**]. As is shown here, the printed copies of the exercises had the final syllable printed in bold letters as a visual reminder to give the increased length required under stress. Subjects were instructed to mimic the speaker in producing these artificial divisions. The second presentation combined the syllables into naturally uttered words; again there was a pause for repetition. The printed copy of the exercise showed the phonetic transcription of the word printed without syllable breaks, but with stress still marked: e.g. [sila**basjɔ̃**]. In a similar fashion, the second exercise presented monosyllabic words ending in consonant sounds. The first stimulus presented these as words composed of two open syllables with the final consonant being followed by a full, syllabic [ə] (i.e. [**ə**]): e.g. *lune* [ly – **nə**]. The second stimulus combined the word into a natural monosyllable uttered with a released final consonant. On paper this was shown thus: [ly**nə̆**]. The exercise session lasted approximately 10 minutes.

In the course of the five following days, there were four additional 10-minute practice sessions so that, in total, subjects had about 50 minutes with the same exercises. On the day following the last practice session, subjects took the posttest, which was identical in form and content to the pretest.

Scoring

For six of the seven features under consideration – rhythmic equality, final consonant release, unstressed vowel centralization, diphthongization, release of word-final [j], and height of constriction of word-final [j] – evaluation was done on a 5-point scale. According to this a score of *5* was assigned to realizations of the feature in question that were judged to be within the range of those of native speakers of French. On the opposite end of the continuum was a score of *1*, assigned to pronunciations which were totally English-like, or which otherwise showed a very strong foreign accent in French.

One of the two judges is a native-speaker of European French with long experience in the study of contrastive phonology as well as in the teaching of corrective phonetics. The other is a native-speaker of North American English who learned French as an adult and who has attained a considerable degree of phonetic accuracy in the language. He has taught French on the high school and college levels for a good number of years. On a sampling of tokens for the features to be scored, the mean correlation coefficient between the scores assigned by the two judges was .83. Though this is comparable to values reported in other studies,[56] for one feature – unstressed vowel centralization – that value dropped to .77. It was decided then to have the two raters evaluate tests as a panel and assign scores after reaching consensus. In order to avoid bias, tape labels were covered so that it was impossible to know whether evaluation was being done on a pretest or posttest.

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[56] For example, Politzer and Weiss (1969: 77) report "a correlation coefficient of .85, which indicated a high degree of agreement".

To obtain data on the remaining feature, aspiration of voiceless occlusives, it was decided to take measurements of voicing delay as revealed on mingographic printouts and simply to record those measurements expressed in units of time (milliseconds). Under other circumstances, it could have been necessary to convert obtained duration values for this to a scale of acceptability-unacceptability similar to that used for the other features. This would apply, for example, if subject values were shown to surround (i.e. be both lower and higher than) criterion values. In this case, however, mingogram measurements of the words considered for aspiration (two tokens for each word), as pronounced by the native speaker of French on the test tape, showed a mean of 15.2 ms. Higher values than those found for this French speaker are reported in the literature. For example, the mean of the VOT durations reported for [p, t, k] in unilingual French speakers by Caramazza et al. (1973: 425) is 24.3 ms., while values shown in Caramazza and Yeni-Komshian (1974: 244) would seem to average out to about 20 ms. Only one of our subjects approached these low values (with 25.7 ms. on the pretest, 18.9 ms. on the posttest); the next lowest pretest and posttest means found were 34.3 ms. and 28.7 ms. respectively. The pretest mean for all subjects was 58.1 ms. With obtained values such as these, it is easy to regard any obtained low value as representing closer approximation to the target norm than any higher value.

VII. RESULTS AND DISCUSSION

On the basis of obtained results, we were forced to make some alterations to the intended analysis. The greatest disappointment was that the "ceiling effect" forced us to eliminate the diphthongization category from the study. The mean of all subject means for this feature was 4.50 on the 5-point rating scale. Nine of the 26 subjects had pretest means of 5.0, while an additional ten scored between 4.5 and 5.0. With such high levels of performance in all but seven subjects, significant change in pronunciation between pretest and posttest would be impossible to find.

In the two categories pertaining to the realization of word-final [j], the test had included three tokens each of the strings [ɛj], [œj], [aj], and [uj]. In words containing the last of the strings, the majority of subjects pronounced a full vocalic [i] in place of [j]; many added stress to this second vowel. Since, in these cases, we were no longer dealing with the type of segment under consideration, we were obliged to omit these tokens from the category. That problem was not observed in words ending in strings other than [uj].

Finally, with regard to the category of final consonant release, though the test included three tokens of each consonant to be considered, we had to reduce that number to two for [n]: both on the pretest and the posttest, the majority of our subjects pronounced *elle fonctionne* with a nasal vowel and no consonant. It seems that, in spite of the three-way stimulus of oral presentation, French orthography and phonetic transcription, subjects were over-generalizing the rule of sound-spelling correspondence according to which word-final *-tion* is realized as [sjõ]. Though it is difficult to identify the source of this problem with certainty, it is likely that the great frequency of occurrence of words in-*tion* and the relative scarcity of words in *-tionne*, especially at beginning levels of study, plays a part. Additionally, there is probably a negative effect of cognate transfer: since there is no phonological distinction between the noun and verb uses of English *function*, it would be easy to expect the same kind of generalization in learners' pronunciation of French; and if such generalization occurs, it would be natural that it follow the direction of greater frequency of occurrence.

Beyond alterations necessitated by the above, data analysis was carried out in line with the stated research hypotheses. Each subject's scores for the tokens within the features under consideration were averaged to obtain an overall mean score for that feature in each of the pretest and the posttest. This score is taken to represent a numerical value for that subject's overall phonetic accuracy with regard to each of the features at the time of that test. In addition, pretest scores for each item were subtracted from posttest scores for that item in order to obtain an "Improvement" value. Thus positive improvement values represent progress in phonetic accuracy for the feature in question, while negative values indicate regression or "back-sliding". Means of these scores for each feature for each subject were then calculated to provide a measurement of that subject's progress during the course of the experiment. It is the means of these subject mean scores which are given in the following presentation. It should be recalled that, for all features other than aspiration of initial voiceless occlusives, scores are based on a scale of 1 – 5, in which high values represent greater phonetic accuracy than low values. Slight discrepancies between Improvement values and Posttest minus Pretest differences are the result of rounding. The tables which follow present the means and standard deviations of the scores obtained by all subjects.[57]

Pretest-to-Posttest Improvement

In order to consider the issue of concomitant pronunciation improvement, it must first be established that there has been significant change in subjects' pronunciation between pretest and posttest. This was determined for each feature on the basis of one-tailed t-tests for the difference between correlated means with *alpha* set at .005.[58]

Results for the two theoretically central features which were included in the content of the instruction and practice exercises are presented first. Table 1 shows the summary of the results obtained from scores on rhythmic equality.

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[57] Mean feature scores for individual subjects are not presented in the body of this thesis. They are attached for the reader's consideration as Appendix III. Appendix IV provides mean feature scores for each test item.

[58] The assistance with statistical procedures offered by Professor C. Varnhagen, Center of Developmental Disabilities, University of Alberta, is hereby gratefully acknowledged. It is this scholar's opinion that, in line with recent trends toward increasing simplicity in statistical analysis, the t-test offers the least complicated view of trends within single variables, where obtained results are reasonably clear. The problem of the increased risk of error created by conducting repeated tests of this kind can be alleviated by appropriate adjustment of the *alpha* level. Thus, when conducting between 5 and 10 such tests, setting that level at .005 ensures that found significance will be at a real level of no less than .05.

Table 1. Rhythmic Equality

	Pretest	Posttest	Improvement
Means	3.81	4.24	0.43
Std. Dev.	0.45	0.55	0.36

t = 6.07 df = 25 p < .0005

Results obtained for release of final consonants are less clear. The reader will recall that, for this feature, instruction and practice were presented in terms of only final [p, n], while testing was conducted on release of all occlusives, two nasals and [l]. Table 2 shows subject results for the taught consonants.

Table 2. Final Consonant Release – Taught

	Pretest	Posttest	Improvement
Means	3.53	4.07	0.54
Std. Dev.	0.96	0.78	1.14

t = 2.41 df = 25 p < .025

These results will be discussed below, for the occurrence of concomitant improvement in untaught features cannot be considered unless we are able to find significant improvement with regard to the taught features. Although, by contrast, significant change in the untaught features is not a central issue here, the results of t-tests for these features are presented for the reader's information. Tables 3 to 6 show results for four of these.

Table 3. Unstressed Vowel Centralization

	Pretest	Posttest	Improvement
Means	3.83	4.22	0.39
Std. Dev.	0.51	0.59	0.39

$t = 5.17$ $df = 25$ $p < .0005$

Table 4. Final Consonant Release – Untaught

	Pretest	Posttest	Improvement
Means	4.06	4.51	0.45
Std. Dev.	0.51	0.40	0.46

$t = 5.02$ $df = 25$ $p < .0005$

Table 5. Release of Word-final *Yod*

	Pretest	Posttest	Improvement
Means	3.77	4.24	0.47
Std. Dev.	0.91	0.82	0.65

$t = 3.66$ $df = 25$ $p < .001$

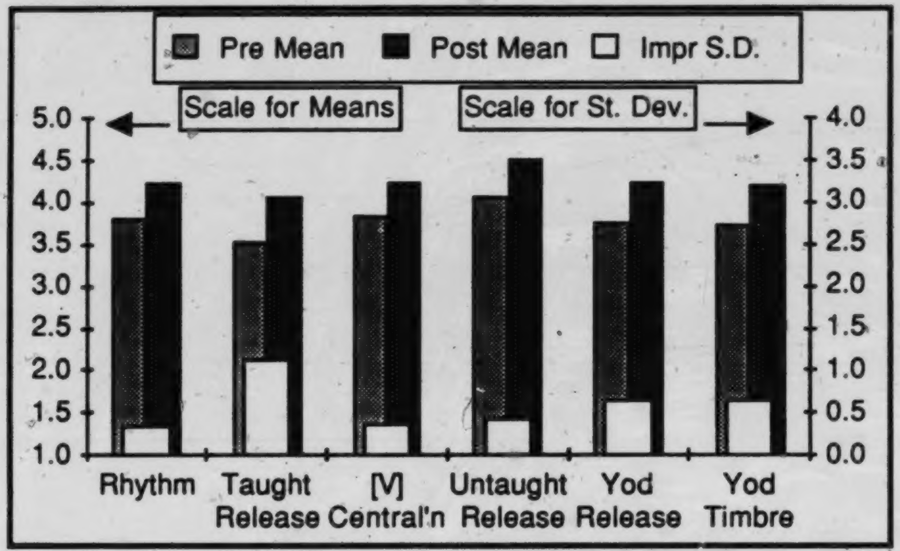
Table 6. Timbre of Word-final *Yod*

	Pretest	Posttest	Improvement
Means	3.72	4.21	0.49
Std. Dev.	0.94	0.82	0.66

$t = 3.76$ $df = 25$ $p < .0005$

As the preceding tables show, subjects' pronunciation improved significantly between pretest and posttest for the taught feature Rhythmic Equality, as well as for the untaught features Unstressed Vowel Centralization, Final Consonant Release (untaught), Final *Yod* Release, and Final *Yod* Timbre. Their pronunciation with regard to the second taught feature, Release of Final [p, n], failed to show significant change at the set *alpha* level of .005. Figure 1 presents a graphic illustration of the changes in means from pretest to posttest, as well as the standard deviation of the improvement means for each of these taught and untaught features which have been discussed so far.

Figure 1. Taught and Untaught Features (excluding Aspiration)



(In order to maintain equal proportions, means are shown on a scale ranging from 1 to 5 while standard deviations are on a scale from 0 to 4. Note also that the first two features, Rhythmic Equality and Final Consonant Release were included in instruction and practice, while the other four were not.)

Results for the final untaught feature, Aspiration of Initial Voiceless Occlusive, have not yet been presented. It will be recalled that, unlike the case of those features already presented, values for this were durational measurements taken from mingograph printouts of subjects' speech. It is because of this different numerical scale that the feature could not be graphically presented with the others. Data for Aspiration are presented in Table 7 and illustrated in Figure 2.

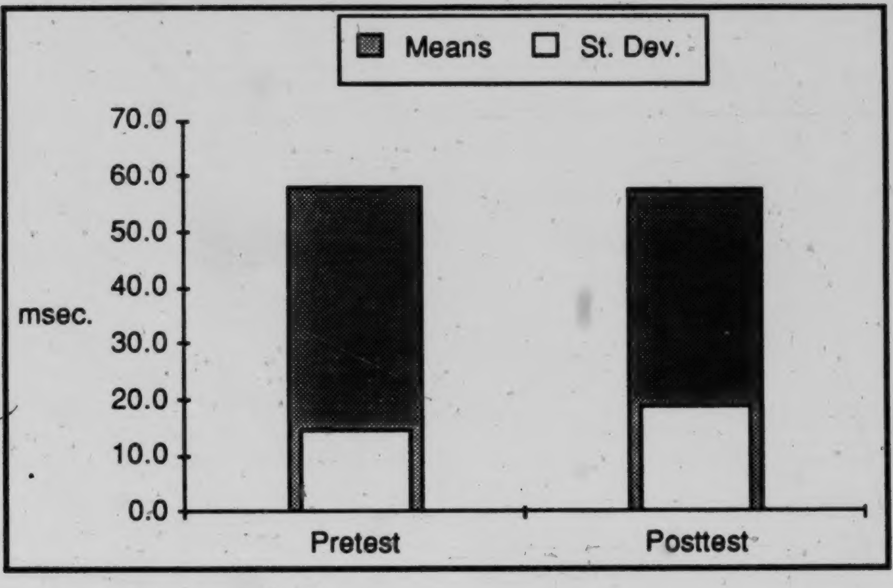
Table 7. Aspiration of Initial Voiceless Occlusive

(Values are expressed in milliseconds)

	Pretest	Posttest	Improvement
Means	58.1	57.7	0.4
Std. Dev.	15.0	19.0	13.6

t = 0.1 df = 25

Figure 2. Aspiration of Initial Voiceless Occlusive



It should be recalled here that, since duration of aspiration is shorter in French than in English, "Improvement" values were obtained by subtracting posttest scores from pretest scores, in order that true progress be shown as a positive number. In contrast to the case of the previously presented features, mean scores for Aspiration on the pretest are nearly identical to those on the posttest;

obtained *t* values consequently fail to show any significance in the difference between pretest and posttest means. Whereas, in previous graphs, we have shown the standard deviation of improvement scores, of greater apparent interest in this case is the change in standard deviation from pretest to posttest – a more considerable change than those shown for the other features. Yet the interest held by that change is more apparent than real. Subjects' pretest means for this feature seem to be broadly in line with experimentally obtained values reported in Caramazza et al. (1973: 425) where unilingual English speakers had means across the three voiceless occlusives of 74 ms., and native speakers of English who had learned French had means of 51.3 ms. Though our subjects show a mean which is perhaps somewhat lower than expected, that mean does lie between these two which have been cited – where one might reasonably expect learners' values to be found. Two subjects (S and X), who already had high VOT means for the pretest (83 and 71 ms.), regressed considerably to 113 and 95 ms. respectively. Their initial consonants were heard as exaggerated bursts, even using English speech as a point of comparison.[59] If one deletes the scores of these two subjects from the calculations, one obtains the results shown in Table 8.

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[59] This phenomenon, according to which learners' realization of certain features resembles neither native-language nor target-language realizations, is a commonly reported characteristic of language learners' speech. For example, Nemser (1971: 119) speaks of "the frequent and systematic occurrence in non-native speech of elements not directly attributable to either to either L_S [i.e. the native language] or L_T [i.e. the target language". See also Tarone (1978: 17).

Table 8. Aspiration of Initial Voiceless Occlusive

(Values are expressed in milliseconds; subjects S and X deleted)

	Pretest	Posttest	Improvement
Means	56.5	53.9	2.6
Std. Dev.	14.4	13.7	11.4

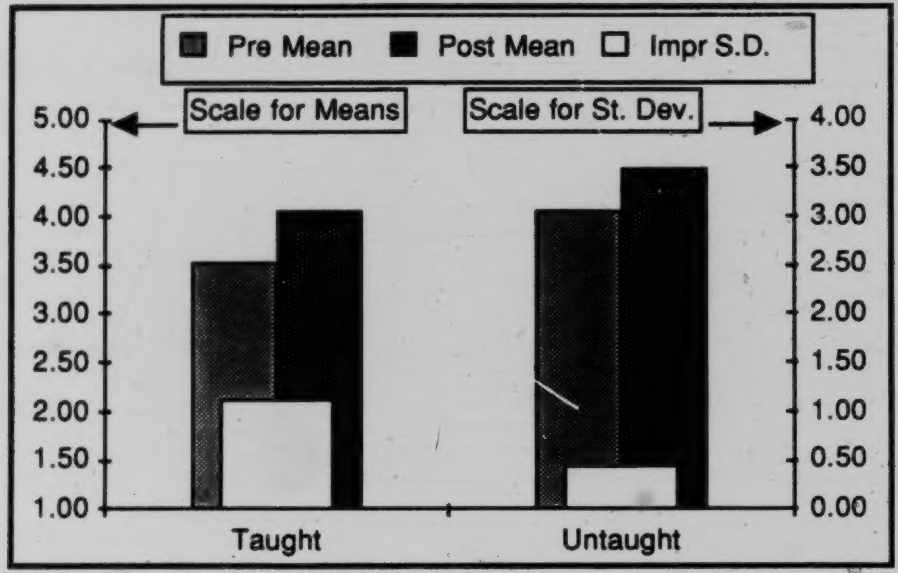
t = 1.1 df = 23

Following the exclusion of these two subjects, there is still no significance in the difference between the means, but the apparent change between pretest and posttest standard deviations has disappeared.

Finally, then, we find subjects to have made significant pronunciation improvement in the taught feature of Rhythmic Equality, as well as in the untaught features of Unstressed Vowel Centralization, Release of Final Consonant other than [p, n], Release of Word-final *Yod*, and Timbre of Word-final *Yod*. No significant difference has been found with regard to the taught Release of Final [p, n], or the untaught Aspiration of Initial Voiceless Occlusive.

At this point, we must return to consider that lack of significant improvement in subjects' pronunciation according to the taught criterion of Release of Final [p, n]. These results are not only disappointing, but also surprising in light of those found for the untaught consonants. Though the mean improvement score for release of the taught consonants is slightly larger than that for the untaught consonants – as one might expect, given that the pretest scores are lower – the t-score for taught consonants is much lower. The reason for this is the wide divergence in standard deviations for the two sets of scores, seen in both the pretest and posttest values, but shown most strikingly in the standard deviations of the improvement scores. Figure 3 illustrates this with its presentation of pretest and posttest scores for taught and untaught consonants as well as the standard deviation of improvement means.

Figure 3. Final Consonant Release – Taught and Untaught



The considerably higher standard deviation of Improvement means for taught consonants (as compared to that for untaught consonants) and the consequent weakened value of *t* seem to have their source at two levels. The first of these is the apparently different treatment accorded by subjects to the consonants chosen for instruction in comparison to other consonants. Test item analysis for final consonant release (cf. Appendix IV) shows some surprising variability for [p]. The mean improvement value for release of voiceless occlusives was 0.29. Included in the test for [p] were *tu l'attrapes,* with an improvement score of 0.04 – the lowest value for any item ending in voiceless occlusive – and *tu la coupes*, with 0.73 – the highest value.[60] A comparable difference exists in pretest scores with the first item having a mean of 3.54 and the second a mean of 3.92. If one calculates the means and standard deviations of pretest raw scores of each test item across all subjects, and then averages those values for each final occlusive, the results presented in Table 9 emerge.

Table 9. Pretest Scores Summary – Word-Final Occlusives

(Values shown are mean values for the three items for each consonant)

	Pretest Mean	Pretest Std. Dev.	Improvement Mean
[p]	3.85	1.39	0.44
[t]	4.28	1.19	0.26
[k]	4.77	0.56	0.17
[b]	4.47	1.04	0.40
[d]	4.47	0.99	0.24
[g]	4.69	0.53	0.26

This table shows [p] to be placed at the extreme end of a continuum in which low pretest means coincide with high standard deviations and *vice versa*. However, while [b] and [d] show near equality both in means and variablity, the same does not hold true for their voiceless counterparts. Among occlusives, then, [p] appears to have presented greater overall difficulty with regard to word-final release than the other occlusives.[61] Whether we are dealing here with inherent phonetic difficulty, or with difficulty resulting from its environments within our chosen items, cannot be determined with certainty. At any rate, the consonant does have lower pretest scores and, in this light, its higher Improvement mean is easy to understand. However, in comparison to untaught consonants, it is the wide variability within subject scores that yields the lower t-score for taught consonants. As the standard deviations presented in Table 9 show, some of that wider variability exists also in pretest scores and, therefore, has its source, in part at least, in something other than the effect of instruction.

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[60] Comparison of these two tokens in the category of Rhythmic Equality shows similar divergence, but in the opposite direction, with considerably greater improvement being made for *tu l'attrapes* than for *tu la coupes*. While, in this latter case, the difference between the two items may have to do with the varying location of word boundaries, the apparent similarity of the phrases makes the observation of their divergent phonetic treatment with regard to release of [p] a perplexing one.

In addition to greater variability within individual consonant scores, we find the same within subjects. Six subjects regressed in their release of [p, n] for a mean Improvement score of -1.03 (i.e. a "back-sliding" score of 1.03), while for taught consonants only three subjects regressed for a mean Improvement score of -0.08. Reasons for back-sliding are always elusive, but such great regressions in the taught category seem particularly so.[62] In the end, it would appear that we are dealing here with some kind of aberrant phonetic behaviour which defies explanation.

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[61] Where nasal consonants are concerned, we notice the same trend, according to which labials appear to be more difficult than dentals. Pretest means for [m] and [n] were 2.50 and 3.06 respectively. In light of this, the greater improvement mean for the former (1.04) as compared with that of the latter (0.69) is understandable. Unlike the case of the occlusives, however, the pretest standard deviation for the labial (1.60) is slightly smaller than that for the dental (1.73).

[62] One example may serve to illustrate how complex the issue might be. Subject X was clearly heard to be suffering from a cold during the posttest. It is quite conceivable that this fact played a role in determining her

It must be recalled here that, since the motivating interest for this study is primarily in applied phonology, the hypotheses are stated in terms of correlated *improvement*. Therefore, for the consideration of any given relationship, those subjects who had a posttest mean for a taught feature which was lower (less correct) than, or equal to the pretest mean were excluded from that statistical procedure. This applied only to non-improvement with regard to the central, taught features. Those who failed to improve in the untaught, but not in the taught, were included.[63] Thus, before carrying out the calculations involved in determining the measure of association between Rhythmic Equality and each untaught feature, we excluded subjects V and X who had improvement scores for that taught feature of -0.27 and -0.14 respectively. The

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regression with regard to Rhythmic Equality (-0.14), Unstressed Vowel Centralization (-0.18) and Aspiration (-24 ms.), as well as her low improvement with regard to Taught Consonant Release (0.20). If that is the case, how can one account for her above average improvement scores in Untaught Consonant Release (0.57) and *Yod* Timbre (0.78), and her outstanding improvement score for *Yod* Release (1.22)? It is only by accident, of course, that we are able to mention this case. Most physical ailments, like cases of emotional stress, are much less audible on recordings than the cold.

[63] This procedure would seem to be motivated by theoretical concerns, as well as by our interest in application. For example, Delattre (1944d: 207) sees the back *r* as a product of vocalic anticipation, but nowhere does he imply that this segment has vocalic anticipation as its only source. To do so would necessarily be to elevate the modes to the level of universals – an objective which Matte (1982: 64) clearly renounces: "Personne n'oserait prétendre que les classifications ci-dessus [i.e. the modes] soient les seules qu'on puisse employer pour décrire les langues du monde. ... l'objet de la présente étude n'est pas d'énoncer des théories universelles."

results of this adjustment are shown in Table 10.

Table 10. Rhythmic Equality – Adjusted Scores

(Non-positive Improvement scores deleted)

	Pretest	Posttest	Improvement
Means	3.82	4.30	0.48
Std. Dev.	0.46	0.50	0.32

t = 7.36 df = 23 p < .0005

For correlations between Taught Final Consonant Release and each untaught feature, the scores of the following seven subjects were deleted: A (-1.00); C (-1.80); D (0.00); G (-0.60); Q (-0.40); R (-1.60); and T (-0.80). After these adjustments have been made, we obtain the values shown in Table 11.

Table 11. Taught Final Consonant Release – Adjusted Scores

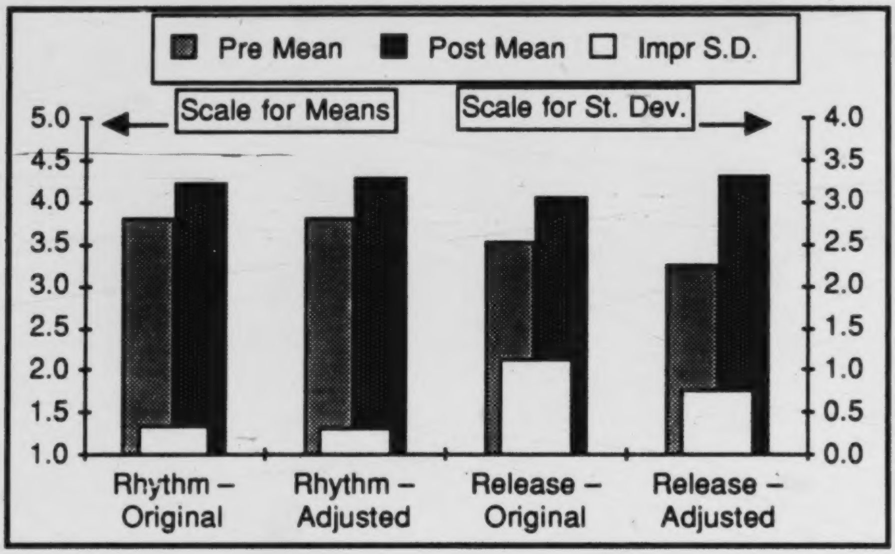
(Non-positive Improvement scores deleted)

	Pretest	Posttest	Improvement
Means	3.26	4.33	1.06
Std. Dev.	0.95	0.64	0.77

t = 6.05 df = 18 p < .0005

The exclusion of two subjects produces little overall change where Rhythmic Equality is concerned; by contrast, after seven non-positive scores have been deleted from the Taught Release category, the Improvement mean is nearly twice as great as the original, while the standard deviation is considerably lower. Considering only subjects who did show improvement then, we find that posttest pronunciation was significantly better than pretest pronunciation with regard to the two taught features. Figure 4 shows a graphic comparison between the original results, in which all subjects are included, and these adjusted results.

Figure 4. Rhythmic Equality and Taught C# Release – Adjusted Scores



It must be noted that there is no claim here concerning the source of that significant change, since instruction was not isolated from practice for controlled consideration. The cognitive facet of the instructional procedures was simply included as part of an attempt – which has been shown to be successful – to produce significant change in pronunciation. It is believed, though not demonstrated, that the attempt was more successful because of it.

Needless to say, it would have been of great interest to control the study so that the value of the cognitive instruction could be considered. Such an experiment would have been possible, had we been dealing with paid subjects. However, it must be remembered that this experiment took place within the context of a French class. It is probable that, as teachers, we do at times lead students into some unproductive class activities; if that is so, it is because we do not know enough about how language is learned. Yet leading students into activities which one *believes* to be unproductive is a different matter, for this practice raises a serious ethical issue: Can one afford to attempt to attain a goal using one method, when another method, believed to be more effective, is available? There is research evidence in Locke (1970) showing that extended mimicking exercise without direction is largely unproductive, yet this study deals with children. There exists, however, stronger motivation than this for avoiding undirected listening and repeating; for the teacher must deal, not only with linguistic reality, but also with the reality of pedagogy. Classroom experience reveals with clarity how counterproductive the tedium and the confusion created by such exercise can be.

One may ask, of course, whether this significant change constitutes *meaningful* change – indeed, that question must always be asked. The mean pronunciation improvements made by our subjects are modest. However, it must be recalled that the purpose of the present study is not to test the value of articulatory instruction, but to investigate the notion of concomitant phonetic improvement. It is on the basis of findings regarding that notion, then, that the question of meaningfulness must be treated. Significant change having been found with regard to the two taught features – subsequent to the exclusion of non-positive improvement scores – we may proceed to the testing of the research hypotheses.

Correlations in Pronunciation Improvement

In order to consider the notion of concomitant pronunciation correction, it is not sufficient to note that correction has occurred following a given treatment. Rather, it must be shown that there is a significant degree of *association* between correction in one pronunciation feature and correction in another. The associations of interest, those delineated in the research hypotheses, are primarily those between the untaught features (seen to be products of Delattre's modes) and the taught features (seen to be central defining traits of the modes). For each hypothesized relationship, a Pearson's Product Moment Coefficient of Correlation was calculated from subject Improvement means and checked against critical values given in Powell (1982) for significance in a one-tailed test.[64] Among measures of association, this appears to be ideally suited to the clear presentation of simple relationships.[65] As was the case with the t-tests above, the increased risk of error associated with the running of multiple tests is controlled by fixing the *alpha* level at .005.

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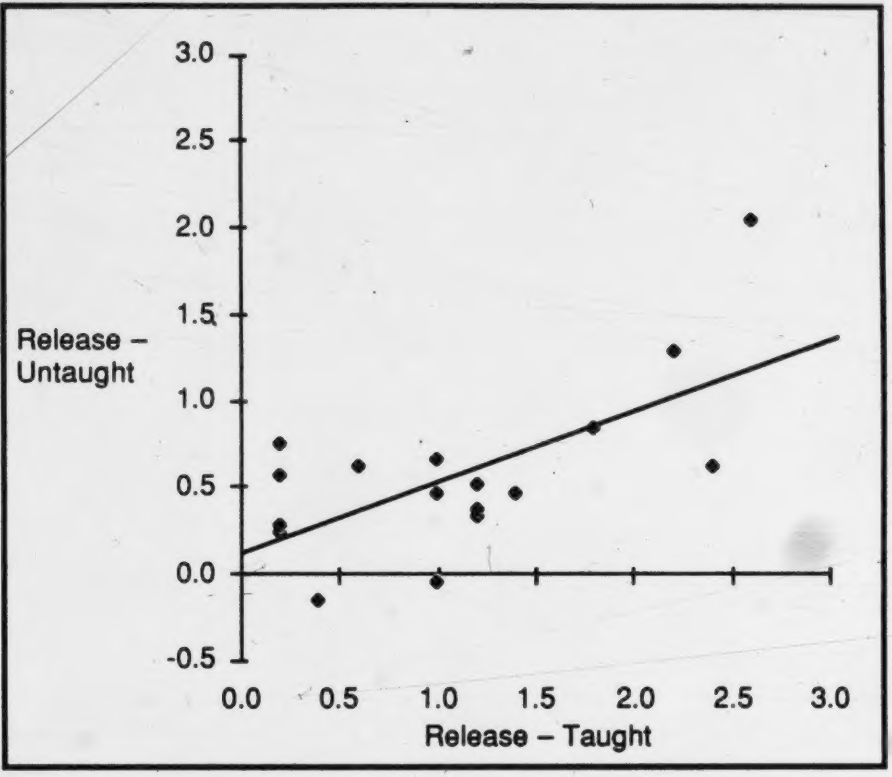
[64] In addition to the assistance provided by Professor Varnhagen (see page 73, note 58, above), we must also acknowledge, here, that of Mr. C. Humphries, Statistical Consultant, Department of Computing Services, University of Alberta.

[65] As will be noted, upon seeing our results, it appears that simple relationships are what we have found. If improvement in a given untaught feature is found to be correlated with improvement in one of our taught features, there seems to be with the other taught feature no real association which can be seen as independent of the effect of the instruction involved in the former relationship. It should be mentioned additionally, that simple correlations permit the exclusion of certain subjects from consideration where one comparison is involved, while not eliminating them from the entire experiment. In this regard, see our procedures on pages 83-84.

Hypothesis 1 states that there will be a significant positive correlation between improvement in release of untaught final consonants and release of final *yod* on one hand and improvement in release of taught final consonants on the other. Figure 5 shows the results of the first of these correlations.

Figure 5. Untaught C# Release / Taught C# Release

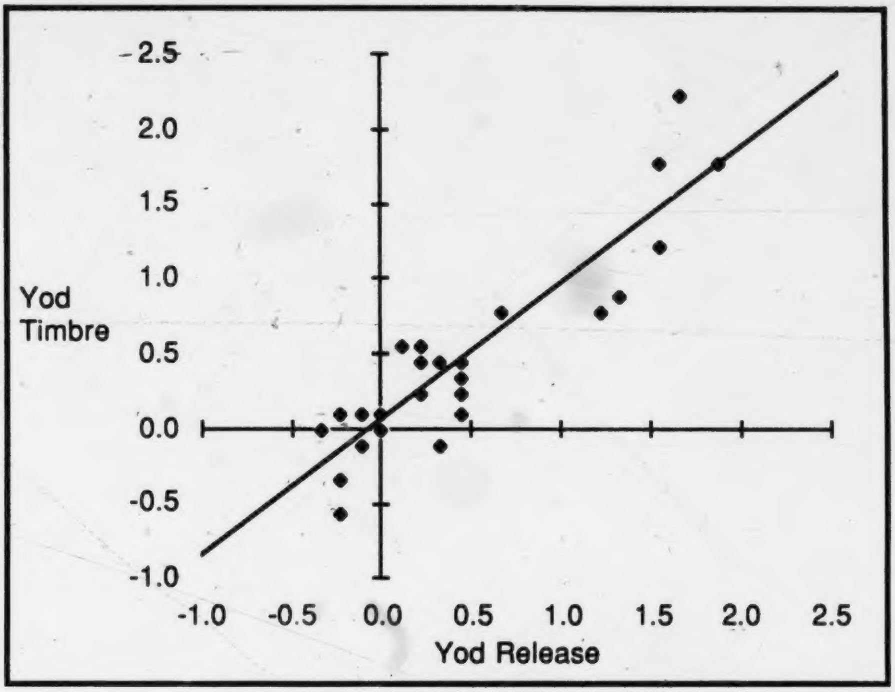


r = .656 df = 17 p < .005

The null hypothesis here is rejected at the chosen level for *alpha*. Additionally, it should be mentioned that this obtained *r*-value only narrowly misses significance at the .001 level of confidence (*r*-crit. = .662). There is clearly a real relationship involved. Though the degree of association between these two categories is not as high as expected originally, it is not surprising in light of the wide variability shown in scores for [p] as compared to the variability in scores for other occlusives. The relative lack of steepness of the regression line is explained, in part, by the fact that, in general, occlusives showed higher pretest values and consequently lower improvement values than continuants. While items ending in [p] provide 60% of the scores for taught consonants, items ending in other occlusives account for 71% of the scores for untaught consonants. Additionally, items ending in [p] showed the lowest pretest scores and the highest improvement scores of all stops. Had a different occlusive been selected for teaching (or different items for this occlusive), the relationship may have been stronger and the regression line steeper.

The next relationship to be considered is that between improvement with regard to release of final *yod* and improvement with regard to release of taught final consonants. The reader will recall that, unlike the case of the two features related above, any association found to obtain between these two categories should involve the reinterpretation of a vocalic element as a consonantal one. Before looking at this question, however, we should show another relationship which, though not central to our hypotheses, should be revealed at the outset. This is the association found to exist between release of final *yod* and height of constriction of final *yod*. Here the data show these two features to be connected so tightly that they appear to be mere facets of a single phenomenon. Since release of final [p, n] was included in the subjects' instruction, we might be led to conclude that release of *yod* had a taught aspect in that it is an aspect of the general principle. On that basis, one might want to exclude subjects who failed to improve with regard to this category before consideration. Yet it is clear from the results shown in Figure 6 that deleting non-positive scores would do little to change the results.

Figure 6. Final *Yod* Timbre / Final *Yod* Release



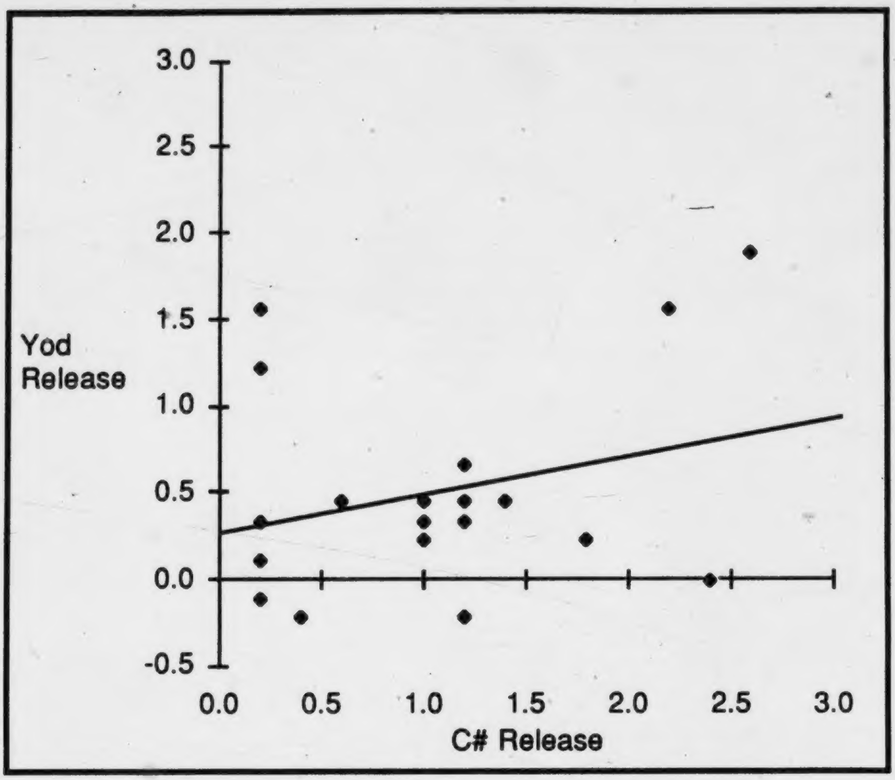
r = .901 df = 24 p < .001

The above results show that if a subject succeeded in giving a stronger release to final [j], he was likely to succeed also in effecting greater closure. Of the 26 subjects, 18 succeeded in making pretest-to-posttest improvement in release of *yod*.

The question issuing from the above, then, is whether or not this improvement is associated with improvement in taught consonant release. Once again, since this correlation is between a taught feature and an untaught feature, subjects who failed to improve in the former have been excluded.

Figure 7 illustrates this relationship.

Figure 7. Final *Yod* Release / Taught C# Release

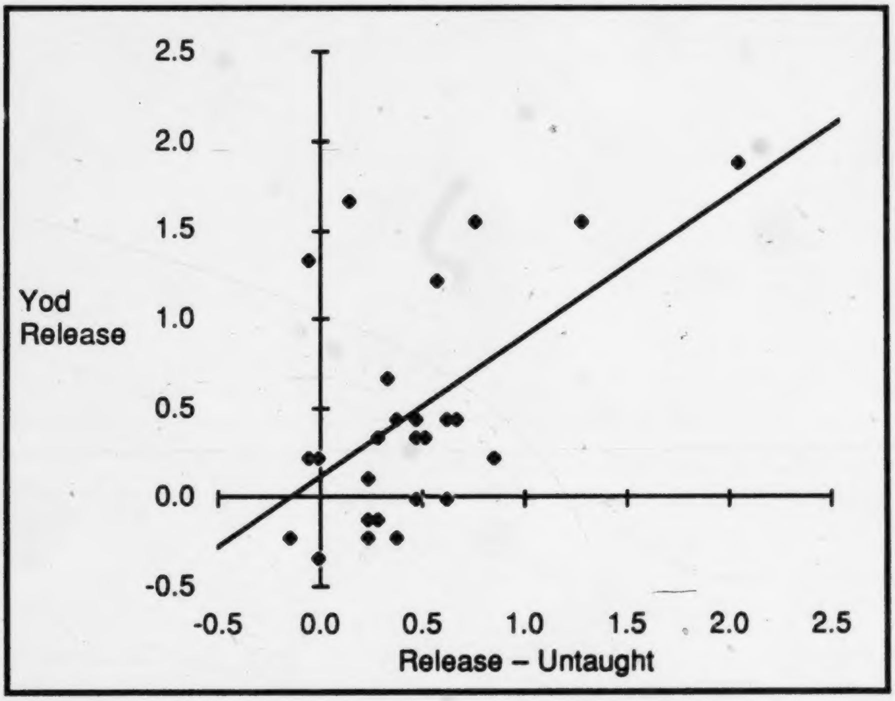


r = .277 df = 17 p > .05

The relationship between improvement with regard to release of [j] and taught consonants is a weak one indeed. Furthermore, it is rather unexpected in light of the number of subjects who were shown to have improved in the former category. It can be said that the relationship is severely weakened by the two subjects who improved greatly in *yod* release, while hardly at all in taught release (upper left-hand corner in Figure 7). In the case of one of these, subject F, the weak improvement score of 0.20 in taught release was the maximum possible, since his pretest score for the feature was 4.80; the "ceiling effect" was consequently operative. The other subject (X) was suffering from a cold on posttest day; this may have altered her performance in ways which are impossible to know (cf. page 82, note 62, above). On the other hand, it may also be said that, without the two subjects in the upper right hand corner of the scatterplot, there would be little relationship at all between improvement scores for the two features.

A more revealing comparison than the above is that of improvement scores for *yod* release and untaught consonant release. This relationship is shown in Figure 8.

Figure 8. *Yod* Release / Untaught C# Release



r = .547 df = 24 p < .005

Once again, since neither of these features figured specifically in the instruction, all scores have been included. As in the preceding case, two subjects in the upper left-hand corner are able to weaken the correlation considerably; this time, however, the positive association is provided by more than two subjects. The trend is a little clearer, if not yet strong ($r^2 = 0.299$).[66]

Further analysis revealed another point of interest with regard to this semi-vowel. For most feature correlations, values remain essentially the same for pretest means as they do for posttest means. Generally, no changes appear to be worthy of consideration.[67] This pattern does not hold, however, for the correlation between *Yod* Release and Untaught C# Release, where pretest *r*-values differ substantially from those found in the posttest. Concerning the pretest stage in our subjects' phonetic competence, we find little basis for rejecting a null hypothesis claiming no positive association between release of final *yod* and release of untaught consonants. Any trend towards a positive correlation is of too little import to be interesting ($r^2 = 0.181$). Figure 9 shows this pretest relationship.

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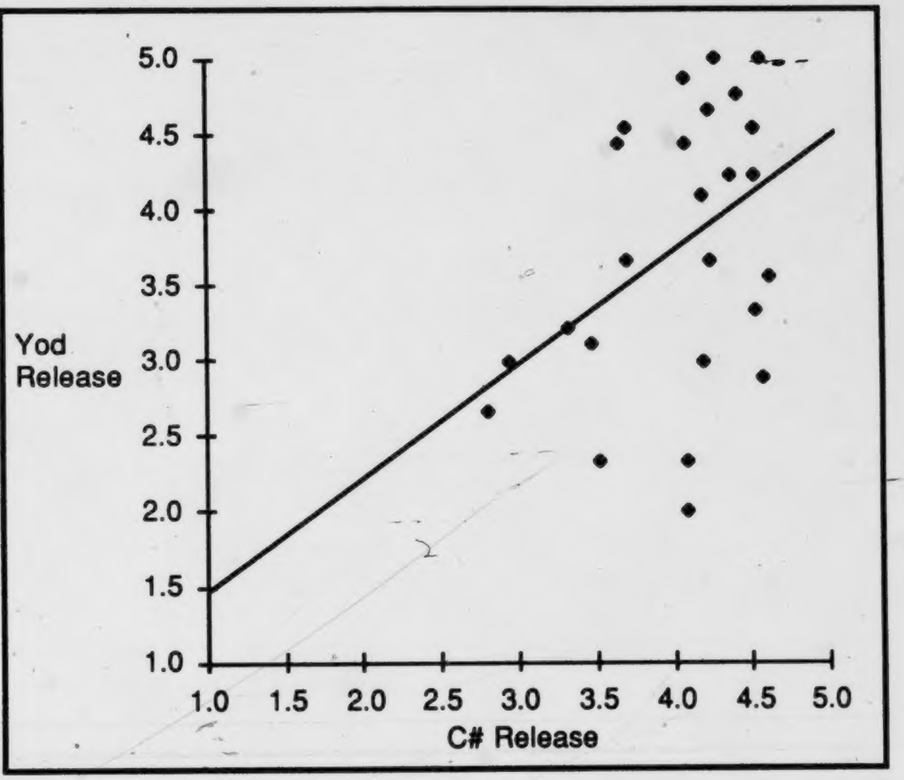
[66] It is perhaps worthy of note that, if scores for items ending in [p, n] are combined with those for items ending in untaught consonants to give an overall measure of each subject's performance with regard to consonant release, and if in addition, the six subjects who failed to show improvement are excluded, we obtain a considerably stronger correlation between this combined category and *yod* release ($r = .680$; $df = 18$; $p < .001$). While this procedure fails to isolate the effect of instruction, there is reason to believe, in light of what has been said, that the combined score presents a more accurate assessment of subjects' overall competence with regard to consonant release, than does the score for [p, n] alone. The possibility of a real relationship between the two features cannot be ignored.

[67] We must note here a weakening of correlation coefficients from pretest to posttest with regard to Aspiration and Taught C# Release: $r = .337$ for pretest; .0.87 for posttest. Yet here, neither value attains significance. Furthermore that weakening would seem to be due to the greater variability in posttest scores for Aspiration (cf. pp. 74-75, above). The impression one gets from seeing those scores, as well as from listening to the tapes, is that our subjects were wandering. Thirteen improved their scores, thirteen regressed. They seem to have noticed a difference between French initial occlusives and those of English, but they were uncertain about how to produce that difference.

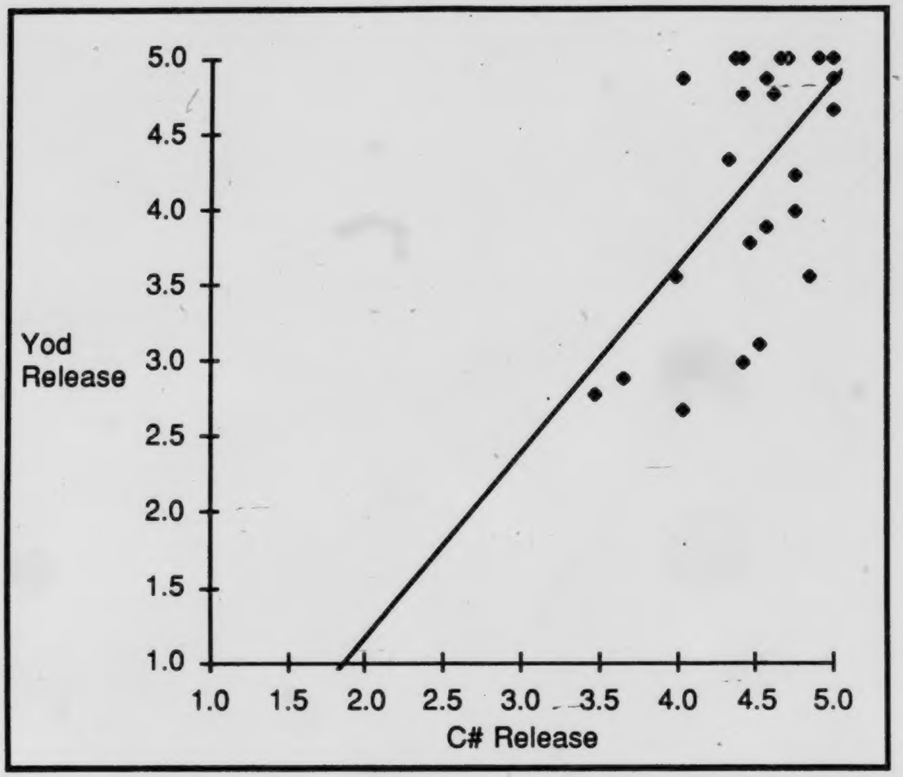
Figure 9. Final *Yod* Release / Untaught C# Release
Pretest



r = .425 df = 24 p < .025

In light of the above, the relationship which exists between the two features on the basis of posttest scores is surprising. Figure 10 illustrates that association.

Figure 10. Final *Yod* Release / Untaught C# Release
Posttest



r = .594 df = 24 p < .001

This substantial difference in *r*-values for *Yod* Release / C# Release between pretest and posttest would seem to give support to the hypothesized change for these words: namely, that the closing element in the [Vj] strings was indeed in the process of becoming a different kind of segment – that is, once felt to be a vocalic element, it was being reinterpreted as consonantal.[68]

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[68] A similar, though less striking change occurs in the relationship between *yod* release and taught consonant release. At the pretest stage we find a correlation coefficient of .139; at the posttest stage it becomes .336. While both these values fail to reach any accepted level of significance, they do show the same trend.

In light of the limited duration of our experiment, it is unlikely that this occurred as the product of a changing articulatory habit at a subconscious level. More probably, it was the product of reinterpretation at the cognitive level: the test script showed a non-vocalic symbol [j] as the final element in these words and could have played a role.

Nonetheless, this change in association between release of *yod* and that of other untaught final consonants occurred. And it may be that it is helping to diminish the apparent strength of the relationship between those two elements. A strong mathematical relationship between improvement in one feature and improvement in another depends on strength of that relationship at both the pretest and the posttest stages. If that relationship is weak at the pretest stage, close association of the two features will exist on only one side of the subtraction formula; the result of that arithmetic operation, then, will appear to reveal a less close relationship than that which is really operative. With that in mind, it becomes conceivable that the measure of association between improvement in untaught final consonant release and improvement in final *yod* release ($r^2 = 0.299$) may indeed be stronger than the numbers allow us to see. If that is the case, it would appear to give evidence to the notion that those subjects who were able to extend the principle of consonant release to include untaught consonants, as well as taught, also tended to be able to apply the principle to *yod*.

Before considering the remaining correlations, we must summarize the results obtained up to this point:

1. There is a significant positive correlation between improvement in taught consonant release and improvement in untaught consonant release (r = .656; p < .005).
2. There is a near one-to-one association between *yod* timbre and *yod* release (r = .901; p < .001).
3. While there is no significant correlation between *yod* release and taught final consonant release (r = .277), there is one between *yod* release and untaught consonant release (r = .547; p < .005). Furthermore, the changing degrees of association between *yod* release and both taught and untaught consonant release from pretest to posttest indicate that both these relationships may be stronger than the present numbers are able to indicate.

For the relationship between untaught consonant release and taught consonant release, therefore, Hypothesis 1 is accepted, while for that between *yod* release and taught consonant release, we are not able to reject the null. In spite of this fact, we have tentative evidence that improvement in *yod* release was connected to instruction and practice in release of [p, n]. We cannot maintain, then, that improvement values for untaught consonant release, of *yod* release and of *yod* timbre are independent of the improvement values for taught consonant release, and consequently, they are not disassociated from the effect of instruction and practice. Subsequent relationships will have to be interpreted in light of these findings.

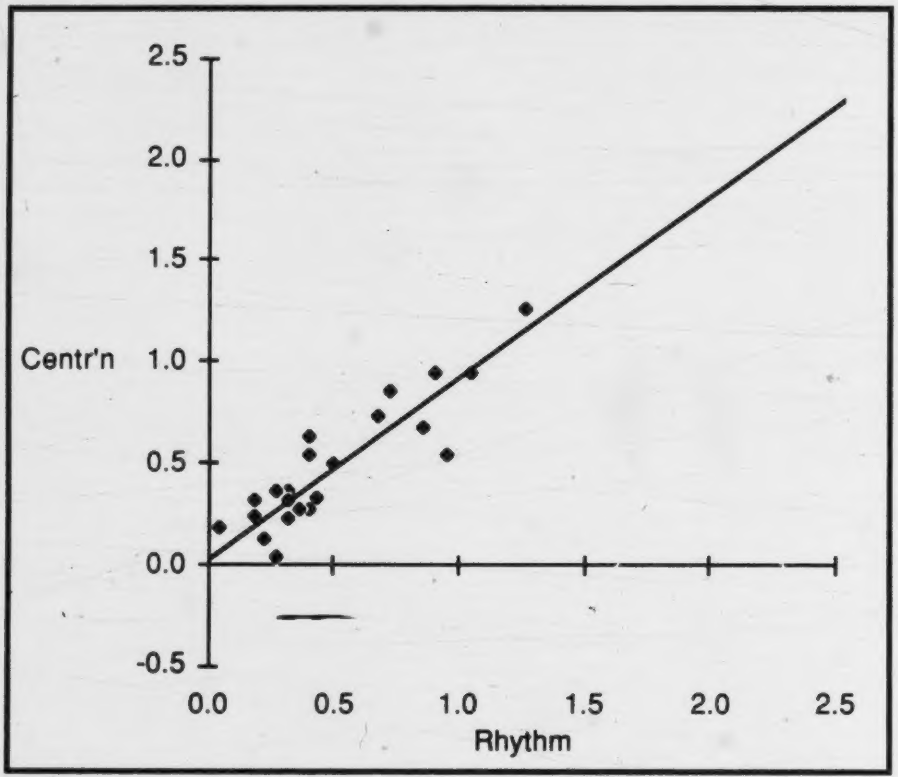
In addition to the above, some further associations, though not included in the hypotheses, must be revealed in order to assist with the interpretation of the hypothesized associations.

1. If we exclude the 7 subjects who failed to improve their pronunciation with regard to taught consonant release, there is a positive correlation between this feature and rhythmic equality ($r = .478; p < .025$).
2. If we exclude the 2 subjects who did not improve their pronunciation with regard to rhythmic equality, there is a correlation between this feature and untaught consonant release ($r = .338; p > .05$).
3. If we exclude the 2 subjects who did not improve their pronunciation with regard to rhythmic equality, there is a positive correlation between this feature and *yod* release ($r = .364; p < .05$).

Though none of the above-mentioned *r*-values reaches significance at the set *alpha* level, the correlations exist. In light of the preceding findings, we are unable to conclude that these relationships exist independently of the effect of instruction and practice in the principle of release of final [p, n] – it is highly possible that this correlation is due to nothing more than that learners who benefit to a greater degree than others from instruction and/or practice in one feature (e.g. rhythmic equality) will similarly benefit more from instruction and/or practice in another feature (e.g. final consonant release).

Hypothesis 2 states that there will be a significant positive correlation between each of the remaining untaught features – unstressed vowel centralization, aspiration of voiceless initial occlusives, and height of constriction of word-final [j] – and the taught feature of rhythmic equality. It should be recalled that these correlation coefficients are calculated following the exclusion of the two subjects who failed to improve in the category of rhythmic equality. We will first consider the relationship between improvement with regard to this taught category and improvement in avoidance of unstressed vowel centralization. As intuition might lead one to believe, these features appear to be merely two different facets of precisely the same phenomenon. The scatterplot in Figure 11 illustrates this relationship.

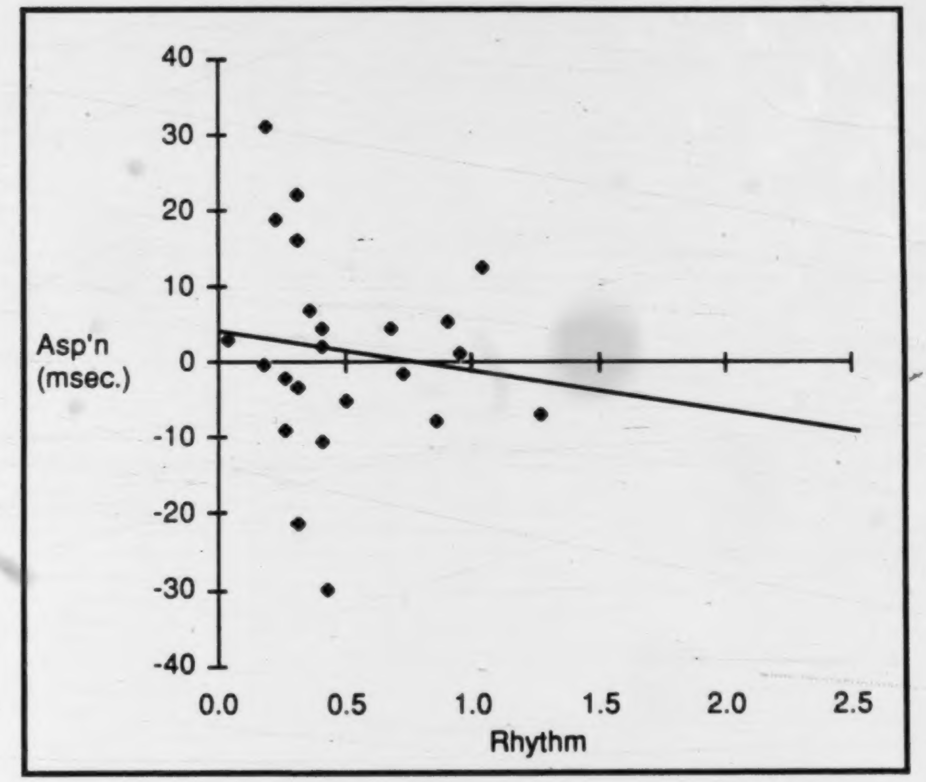
Figure 11. Unstressed Vowel Centralization / Rhythmic Equality



r = .901 df = 22 p < .001

By contrast with the above, where Aspiration of Initial Voiceless Occlusives is concerned, there appears to be no meaningful association of any kind with Rhythmic Equality, as might have been predicted from the results presented earlier in the discussion of Pretest-to-Posttest Improvement. The improvement mean for all subjects was less than 1 millisecond; if any quality is characteristic of the trend shown by change scores for VOT, it is certainly that of extreme variability. This is illustrated graphically in Figure 12.

Figure 12. Aspiration of Initial Voiceless Occlusive / Rhythmic Equality

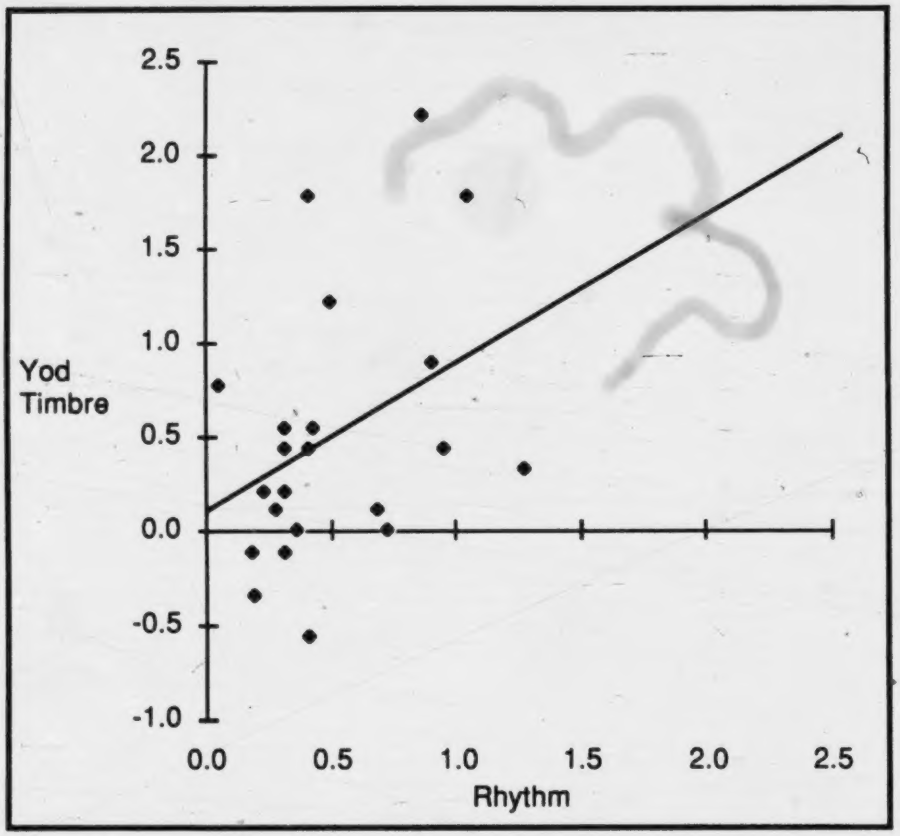


r = -.128 df = 22 p > .05

It was mentioned earlier that two subjects had voicing lag time measurements on the posttest well in excess of normal English values. One of these (subject X) has already been excluded from the above on the basis of her regression with regard to Rhythmic Equality. If the scores of the other (subject S: Rhythm 0.43; Aspiration -29.8) are deleted, the negative correlation is strengthened (r = -.169; df = 21), but still falls far below any accepted level of significance on a two-tailed test.

Figure 13 illustrates the relationship between height of constriction of final *yod* and rhythmic equality.

Figure 13. Final *Yod* Timbre / Rhythmic Equality

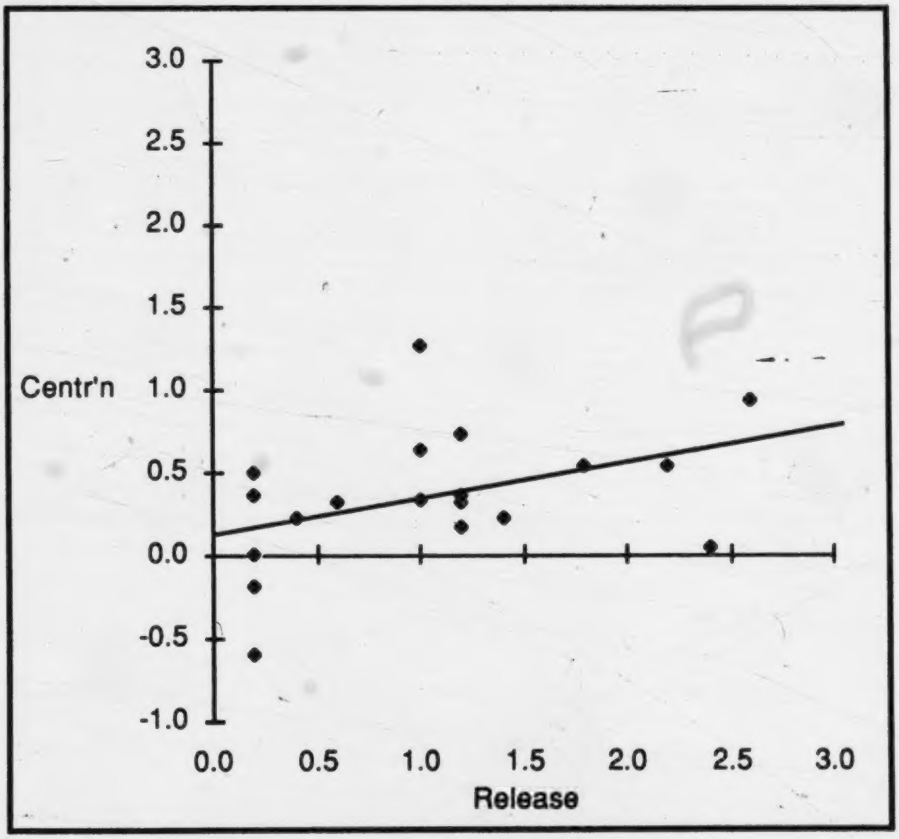


r = .371 df = 22 p < .05

As could be predicted in light of the weak positive correlation between rhythmic equality and *yod* release and in light of the very tight bond between the latter feature and *yod* timbre, this feature shows a positive correlation with Rhythmic Equality, but it is too weak to allow us to reject the null. Additionally, as was mentioned earlier with regard to *yod* release, it is probable that this relationship follows from the association noted between untaught release and rhythm, which must be viewed to be contaminated by the effects of instruction.

Hypothesis 3 states that there will be a significant positive correlation between each of the untaught features and that of taught final consonant release. These *r*-values are calculated following the exclusion of the seven subjects who failed to improve in the category of taught consonant release. Figure 14 shows the first of these relationships.

Figure 14. Unstressed Vowel Centralization / Taught Consonant Release

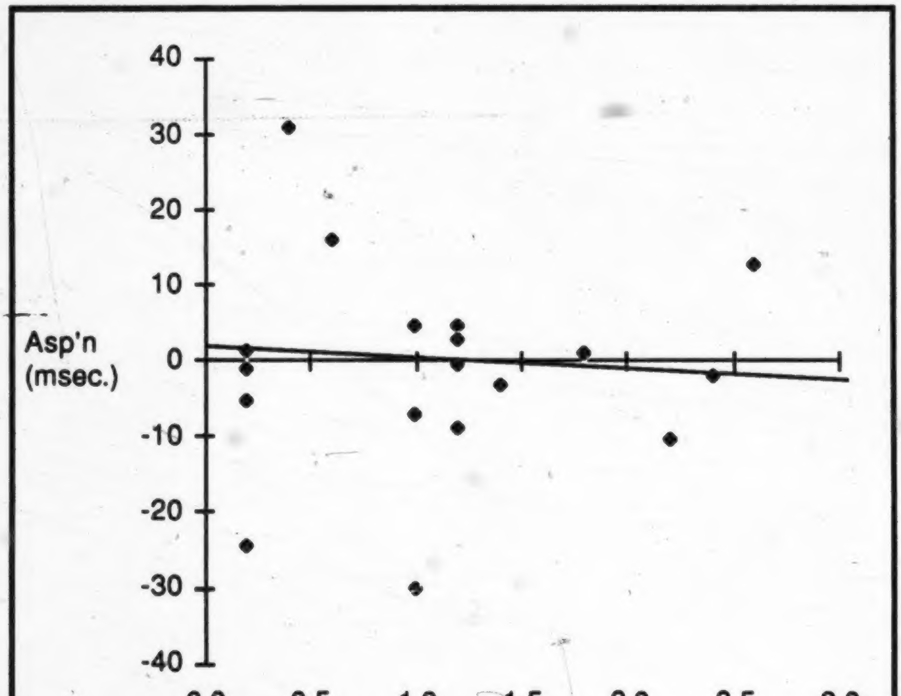


r = .413 df = 17 p < .05

These results are not surprising in light of the fact that rhythmic equality and the avoidance of centralization of unstressed vowels have been shown to be virtually identical phenomena, and in light of the *r*- value of .338 (reported earlier) between the former of these two features and Final Consonant Release. As was the case for that correlation, in this instance also we fail to find significance.

The results concerning the hypothesized relationship between Aspiration and Consonant Release are no more surprising. No considerable correlation can be found, as is shown by Figure 15.

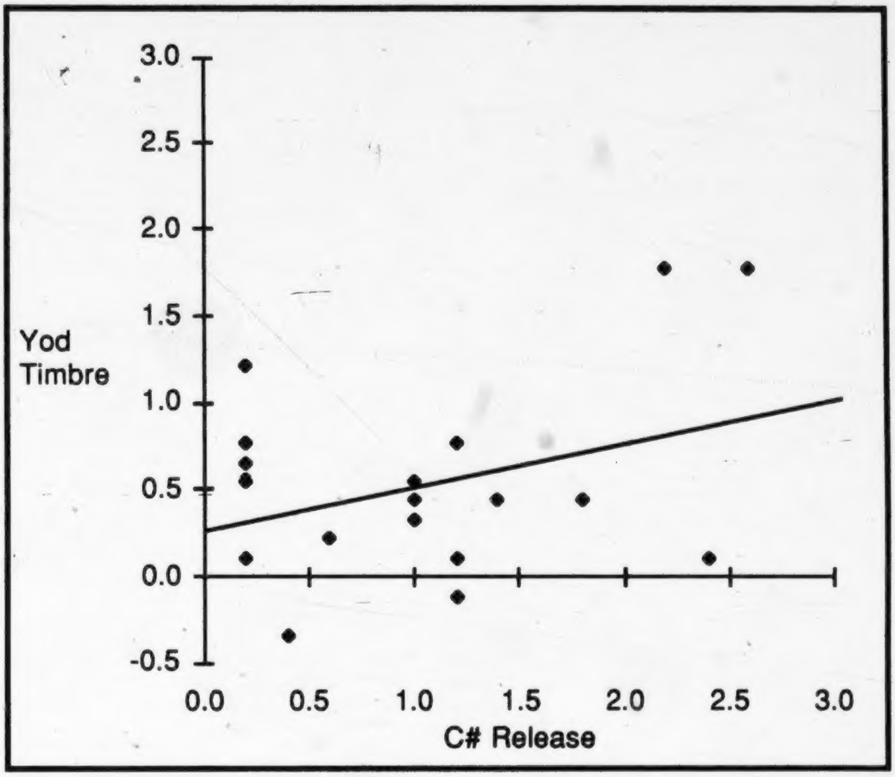
Figure 15. Aspiration of Voiceless Occlusive / Taught Consonant Release



r = -.080 df = 17 p > .05

Figure 16 shows the correlation between improvement in height of constriction of final *yod* and improvement in taught consonant release.

Figure 16. *Yod* Timbre / Taught Consonant Release



$r = .341$ $df = 17$ $p < .05$

In light of the near one-to-one correlation between *yod* timbre and *yod* release, and the *r*-value of .277 found between this feature and taught consonant release, the present results bring no surprises. As was mentioned earlier with regard to that former correlation, there is indication that these associations may be stronger than our numbers indicate; at this point, however, the data do not permit us to make firm conclusions on the issue.

VIII. CONCLUSION

Having found relationships of greater and lesser significance, one must inevitably broach the further question concerning the meaningfulness of that significance. Across feature categories, subjects' pronunciation improvements were modest indeed. If one considers the data summaries presented in Appendices III and IV, it becomes clear that the "ceiling effect" played its part in preventing higher improvement scores for all features but Aspiration: improvement is difficult to foster when there are no errors to correct. This ceiling effect was operative at both the level of the test item and that of the subject.

At the item level, we can consider the category of Final Consonant Release. For final occlusives we find a pretest mean from all subjects of 4.42 and an improvement mean of 0.30 on the 5-point scale. By contrast, those means for continuants are 2.91 and 0.86. A further example can be taken from Unstressed Vowel Centralization data. In most three-syllable words, it was virtually without exception that the vowel of the second syllable would be the victim of reduction if reduction occurred. For words in which that syllable contained the vowel [i], we have centralization means of 4.66 on the pretest and 0.08 in improvement. By contrast, for words whose second vowel is [a] (if we exclude the word *lymphatique*, whose English cognate has second-syllable stress), we find pretest and improvement means of 3.09 and 0.78 respectively. To exclude those items which were found to be pronounced accurately on the pretest is to obscure important aspects of linguistic reality, while to include them is to conceal the degree of improvement which really occurred in subjects' speech.

Where subjects are concerned, a glance at the number of subject means which are greater than 4.00 on the pretest is sufficient to see that improvement levels were limited.[69] However, excluding these subjects would have left us with an insufficient sample population. Therefore, as a consequence of the ceiling effect and, no doubt, of other factors which remain unexplained, the improvement scores are not high. Yet it must be recalled that the purpose of this study has been to look, not at degrees of improvement, but at concomitance in improvement in taught and in untaught features. For the study of this question, the effect of small ranges of improvement scores would be to fail to reveal as significant certain meaningful relationships which may indeed exist over the full span (1 to 5, on the scale used for this study) of the English-like – French-like continuum. Some of the weaker relationships presented in the section on results and summarized below may well fall into this category. For now, firm conclusions with regard to these relationships are impossible. On the other hand, where even a limited range of improvement scores, such as those presented in this study (0.05 to 1.27 for rhythmic equality, for example), shows significant associations, those associations are almost certain to exist across the full continuum as well as they do within our restricted span. Of course, the final shape of the relationship can only be guessed at; one which appears linear at a micro-level, for example, may be shown to be curvilinear in the overall picture, but it is unlikely that the strength of the association would be weakened. Therefore, if, on the basis of results obtained here, we find support for a given research hypothesis, that support is probably more meaningful than a failure to corroborate another hypothesis.

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[69] It should be noted here that our subjects' overall strong performance on the pretest was quite unexpected in light of their in-class pronunciation. To take the most blatant example, countless diphthongs were heard in their speech each class day of the term. On the pretest, we could find only isolated cases of diphthongization. This underscores the importance of the distinction between *competence* – what learners are able to attain with regard to phonetic correction – and *performance* – the level of correction which their speech generally shows.

Summary of Results

When one is dealing with an applied field of study, one must ask not only whether significant relationships are meaningful, but also whether they are valuable. We will consider this question as we summarize the test results. From the outset, it must be stated that the most disappointing aspect of this study by far was the fact that we were unable to investigate the phonetic difficulty of diphthongization because of the paucity of errors in this feature made by subjects on the pretest. The discovery of a strong positive correlation between this feature and one of the taught features would have been a valuable one indeed.

Concerning the features which we have been able to investigate, we have found a significant positive correlation ($r = .656$; $p < .005$) between improvement in untaught consonant release and in taught consonant release. Though this relationship is weaker than expected, there is reason to believe that it may have been stronger, had we chosen to teach the principle in terms of an occlusive other than [p]. Conversely, the association between release of final *yod* and taught consonant release fails to reach (r = .277; p > .05); still, there is evidence to lead us to believe that this relationship is stronger than the present numbers are able to indicate. Nonetheless, even if future research were to show that both these relationships were much stronger, the practical value of that knowlege in terms of its application in the pedagogy of phonetic correction would be slight. The gains to be realized by the exclusion of these individual segments from the instruction of consonant release – in terms of both economy of time and reduction of complexity – are minimal. There is no real benefit to be gained by not including all consonants in the presentation of the principle and in the practice exercises.

In addition to the above, though this is not a central part of the present study, we have noted that release and timbre of *yod* are almost on a one-to-one relationship (r = .901; p < .001). With regard to the applicability of this knowledge, it must be noted that, if we can bring students to release this semi-vowel clearly enough, we can be confident that the correction of the problem of inadequate raising will follow. Still, in the end, it must be noted that the gains derived from this deletion in terms of increased simplicity in the curriculum may also be negligible: as yet, there is no empirically demonstrated reason to believe that pre-vocalic semi-vowels will be adequately raised and shortened concomitantly with improvement in some articulatory setting. As long as this cannot be done, the necessity exists for the treatment of individual semi-vowels as elements contrasted with their vocalic counterparts.

Concerning maintenance of rhythmic equality and its hypothesized phonetic products, we have noted the apparent beginning of an association between this setting and timbre (i.e. height) of final *yod* ($r = .371$; $p < .05$), though it fails to reach significance at the chosen *alpha* level for the family of tests. If there are connections here, they would appear to be the consequence of the relationship noted between rhythmic equality and consonant release. If this is so, we are not able to claim that instruction has not had a direct effect on both features; consequently, we are not able to maintain that concomitant improvement has occurred.

The findings lead us, however, to accept that rhythmic equality has a close, positive relationship with avoidance of centralization of unstressed vowels ($r = .901$; $p < .001$). Though this is not surprising, there is perhaps value in the fact that it has been demonstrated, as it may have some applicability. It is felt that beginning students, in particular, are more receptive to statements concerning rhythmic equality (such as those contained in the instruction for this experiment) than they are to notions such as the "maintenance of cardinal vowel values", or the like.

Concerning final consonant release and its hypothesized products, we find a weak association between this feature and atonic vowel centralization ($r = .413$; $p < .05$). In light of the near one-to-one relationship between this latter feature and rhythmic equality, we are certainly dealing here with the effects of teaching on both sides of the correlation. Even if the *r*-value reached significance, the association would be devoid of meaning from the perspective of this study.

Four of the untaught features, unstressed vowel centralization, untaught consonant release, *yod* release, and *yod* timbre, seem then to be tied – more or less closely – to the taught setting features. And if a taught feature is related to one setting, it seems not to be related to the other in any important way, at least insofar as the present data allow us to see. For now we can conclude only that we appear to be dealing with simple relationships. Further research may one day provide clarification.

For the fourth untaught feature, aspiration of voiceless occlusives, the results are disappointing: this source of pronunciation error is one for which understandable articulatory descriptions seem so difficult for teachers to formulate and for learners to apply to their speech. The wide variability shown in the subjects' mean improvement scores for this feature leads us to conclude that it has no association with either of the two setting features. The patterns observed would suggest that, even over the full span of the English-to-French improvement spectrum, a significant relationship is unlikely to exist.

In the end, then, we have made no discoveries of far-reaching import with regard to their immediate applicability within the phonetic correction segment of the language curriculum. If the present study offers any contribution to the field of Applied Phonology, then, it is its suggestion of a direction for future research. Among the presented feature comparisons, we have found correlation coefficients of almost 1.00 between rhythmic equality and avoidance of unstressed vowel reduction, and between release and timbre of final *yod.* Yet these correlations deal with related articulations within the same word. It is believed, however, that the most revealing association to emerge from the present results is that which exists between [j] and other final consonants; this in spite of the low correlation coefficient found for the relationship between release of this segment and release of taught consonants. For this association exists only outside of individual words – the only common ground for the two features is their place within their respective words and within the individual speaker. Finally, since we found no significant associations between aspiration and the taught features, and since we were unable to investigate the feature of diphthongization, it is this *Yod* / C# Release relationship alone which gives any indication of the existence of a suprasegmental governing mode or setting which controls or influences the realization of individual segments across utterances.

It must be acknowledged here that, in light of the limited time span of this experiment, we can make no claim to have witnessed a real change in subjects' articulatory *habits*, which settings are held to be. It is not at all improbable that the pronunciation improvements made by these subjects with regard to the taught features were the result of cognitive attention to the principles involved. Yet, concomitant improvement has occurred; and with extended practice over time, associations which exist on a cognitive level can become habitual associations.

Future Research

Since pronunciation improvement with regard to one phonetic feature has been shown to occur in conjunction with improvement with regard to another, the phenomenon certainly merits further study. Correlational tests of the type conducted here are a necessary part of this further study. The present results, however, offer some suggestions for experiment design for future research. We have noted as one issue the limited time span of this experiment. It is clear that we did not, during its short duration, create any new articulatory habits. Some relationships between segments and settings may well be revealed only after the settings have become habitual. Longer term investigations are thus required to consider the reality of settings. On the other hand, where the issue is improvement of the untaught concomitantly with improvement of the taught, the time span of experiments must be decided with care. Though added time allows us to study the durational aspects and the linguistic reality of relationships, it also allows for increased contamination of results through the breakdown of controls. For example, if such research is being conducted within the context of language classes, as in the case of the present study, and if a control group is to be deprived of information concerning settings, some classroom questions from subjects can present serious difficulties for the teacher. One such as "Why is it that French words all seem to run together so much?" can really be answered only in terms of the tendency to maintain open syllabification. An honest answer to the question may well constitute instruction on articulatory settings. The same difficulty exists if one is attempting to provide general instruction with regard to settings while withholding detailed articulatory instruction on features to be investigated. To take the difficulty of aspiration as an example, one can see the problems which would be presented by a question such as why the initial *t* in *tête* sounds like *d* when a French speaker says the word. The difficulties involved in preserving the controls increase dramatically as time increases. In the classroom situation, short-term studies can sometimes be the only studies possible when practicalities are considered. In spite of their limitations, however, they can add to the body of linguistic knowledge.

A second issue involves the scope of a study. Since the objective of this study was investigative, we chose to consider several features which are theoretically related to two other general setting features. As an investigative procedure, it can perhaps claim some little success; on the other hand, it fails to pronounce the last word on the issues considered. The study has provided evidence for some relationships; in the case of the connection between final *yod* and taught consonant release, it has hinted at the existence of a relationship all the while failing to provide incontrovertible support. In this case, a more appropriate design is suggested by consideration of the varying treatments accorded by subjects to different test items containing final [p]. In this case, more occurrences of each final consonant in both monosyllabic and polysyllabic words may have yielded clearer results. In the case of test items for rhythmic equality and vowel centralization, though a greater number of words would have been unlikely to change the results concerning relationships, a more complete representation of all vowels in syllables subject to reduction may have provided an indication of which vowels are most likely to be the victims of strong reduction. What is called for, then, is a test in which each feature is scored on the basis of a substantially greater number of tokens; in this way, each environment type can be represented in several items. However, tests must be of limited length. Subjects cannot be expected to expend their best effort in listening and repeating tests for an unlimited time. At some point, results are sure to show the contaminant effects of wandering attention. The imperative, then, is to investigate fewer features, but in greater depth, in order that trends be observed with as much clarity as possible. It must be noted, however, that, included with this recommendation, is a caveat: in order that we investigate genuinely *concomitant* improvement, subjects must not be able to identify which phonetic features we intend to investigate. The danger associated with the administration of tests containing a large number of items having similar features is that subjects may become aware of those features as a result of signals contained in the test. If they are able to do that, they will certainly give conscious attention to those elements and thus prevent the researcher from investigating real concomitant improvement.[70]

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[70] An anecdote will perhaps give support to the reality of this danger. A pilot experiment on the subject of concomitant improvement was conducted several years ago. In this investigation, we were considering, among other features, the problems of nasalization of oral vowel before nasal consonant and intrusive nasal consonant between nasal vowel and oral consonant. Following the pretest, one of the subjects offered the following: "I don't know all the things you're looking at, but I do know that nasals are one of them."

Finally, it must be noted again that the success of the present study appears to have been diminished by the ceiling effect. With the exception of those for the feature of VOT, subjects' errors were neither as numerous, nor as serious, as we had expected. To repeat a previously given example, countless cases of diphthongization were heard daily – both before and after the conducting of the experiment – in the day-to-day interchange within the class. On the pretest, there were only isolated errors of this type. This points to the need for going beyond isolated words and phrases in tests to include full sentences. Additionally, in order to evaluate the ultimate effect of training in settings on the pronunciation of learners, it would be beneficial to evaluate their speech produced when their focus of attention is on something other than pronunciation. Ideally, of course, this would involve speech offered for communicative purposes, however, in this case, one is rarely certain to find the segments which one is interested in investigating. As an alternative, syntactic exercises could be designed where responses would contain the elements of interest.

Correlational tests of the type conducted here are a starting point, for they present a measure of association between pronunciation realizations. These are necessary in that they can provide valuable knowledge, but they are not sufficient. Insofar as settings function on an articulatory level, it must be to articulatory research that we appeal in order to determine precise definitions of those settings. Pierre Delattre conducted a considerable amount of this type of study for English, French, German and Spanish. Homiedan (1984) has begun to formulate a physiological contrast between English and Arabic. Such studies, interesting and necessary as they are in providing potentially salient contrasts, fail to provide the knowledge we need in order to make the most valuable pedagogical application of the notion of articulatory settings. For in order to give settings their rightful place within the curriculum, we must know, not only that native speakers of the target language have a tongue anchorage which is different from that of the learners, or that their cheeks are more drawn in, we must know also the phonetic products of those settings. That is, measurements of articulatory parameters must be correlated with pronunciation scores derived either by judging or by instrumental acoustic measurements.[71] At the beginning, this must be done with native speakers of the two languages being contrasted in order to define contrasting settings. Secondly, it should be done with learners, who are in the process of changing their articulatory settings in order that we might see how changes in settings are correlated with changes in phonetic product.

While it is quite easy to make pronouncements concerning the type of research which must be conducted to provide the kind knowledge we need, the actual conducting of that research is a different matter. Obviously, empirical data with regard to articulatory processes are extremely difficult to obtain. The realization of the health hazards involved in the repeated exposure of subjects to X-rays has virtually put an end to the type of articulatory research conducted by Delattre during the 1960's. One of the few research tools available to the researcher at this point is the pseudopalate, such as that used by Homiedan (1984). In his experiment, for each subject, two pseudopalates (upper and lower) were produced from thin (0.3 mm) plastic sheets. Shaping of the devices was done to match custom-made dental impressions. Into each of these were embedded 96 electrodes which would sense and provide a record of points of tongue contact across speech utterances. These records could then be analyzed by computer. Homiedan relates some of the procedures involved in the preparation and fitting of these devices (pp. 81-82). Without repeating these, we can note that the process is complicated and apparently extremely expensive. It is no doubt for this reason that this researcher was able to work with only six subjects, 3 for Arabic, and 3 for English. The amount of work and the expense involved in working with more are understandably prohibitive. Yet one must wonder how generalizable conclusions can be, if they are based on this number of subjects – particularly when one takes into account the anatomical differences which must exist from subject to subject. This is not to diminish the importance of this scholar's work; rather, it is to emphasize the point that it must be supplemented by more of the same, before firm conclusions can be made.

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[71] It must be noted, however, that acoustic measurements cannot readily be obtained for all features which one might want to investigate. For the present study, it was originally intended to obtain spectrographic data for rhythmic equality and final consonant release. The procedure had to be abandoned. On spectrograms from some subjects, it was impossible to determine with any reasonable degree of accuracy the boundaries between vowels and some consonants; durational measurements were consequently out of the question. Similarly, these printouts failed to show some cases of clearly audible release of final consonants. At this point, we have not yet seen instruments which have matched the sensitivity of the human ear.

A second question presents itself. The thinness of the pseudopalate is impressive. In addition, efforts were made to ensure that the device would feel as comfortable as possible in the mouth of the subject. Finally, before measurements were taken, a 20-minute practice period was allowed in order to "adjust the articulators to the foreign object in the mouth" (pp. 82-83). For all this, one must wonder how natural speech can be under these conditions, given the natural human intolerance for such foreign objects in the mouth. Once again, conclusions based on data furnished by this type of device must not be accepted without a certain amount of questioning.

Finally, it must be mentioned that, in this case, at least, the pseudopalate is capable of measuring only one aspect of articulation – that is, tongue contact. And while Homiedan maintains that "tongue anchorage is the core of the theory of articulatory setting" (p. 27), it must be noted that it is only with regard to the *mode antérieur* that anchorage would have any place at all within Delattre's theory of the modes. All this is to say, then, that though articulatory knowledge is what is needed before we can make optimal use of settings in the teaching of phonetic correction, at this point, most of that knowledge is beyond the reach of researchers.

Finally, the applicability of notions concerning articulatory settings must be tested in the classroom. We need to have an idea of the relative effectiveness of approaches based on mimicking alone, on detailed articulatory description and practice, and on instruction and practice in generalities concerning settings. Thus experiments must be conducted in which various approaches are isolated for investigation – a procedure which was unfortunately impossible for the present study. This type of experiment, from the point of view of application, constitutes the ultimate test of the concept. It is not enough that a given setting be found to have an articulatory and linguistic reality; for in the end, that setting must be found to be describable in terms which students can understand and act upon, and its inclusion in instruction must be found to produce the desired results.

Until some of this knowledge is forthcoming, it would be prudent to temper pedagogical pronouncements with regard to modes or settings. The field would appear to be a rich one for further study, but at this point we must not ascribe an inordinate amount of power to the notion. As theoretical constructs within which the teacher and the student can organize the phonetic minutiae of contrasts, they may have a rightful place in the curriculum – but this is on the basis of motivation from pedagogical principles, rather than from linguistic ones. Linguistic knowledge may one day prescribe the application of the notion of settings, not as a cognitive aid, but as a necessary first-order element of the curriculum. This notion, empirically corroborated, may be able to prescribe the ordering of the content of the curriculum, and, at best, to supplant some of the details of the content which were found to be unnecessary inclusions. We have not yet reached that point.

Above all, we must not assume that all phonetic difficulties involved in learning a new language will be eradicated by the mastery of one or several articulatory settings. Delattre (1953: 9) has done just that. This study raises strong doubts with regard to the placement of one of these difficulties –

aspiration of voiceless stops – within the framework of the modes. That several (or many) difficulties eventually fail to be explained by variation in settings should not surprise us. Kohler (1981) has demonstrated a complex interaction between different kinds of cues in the perceptual distinction between voiced and voiceless stops by speakers of German listening to French. In this same article, he notes:

> The articulatory and auditory repertoires in average users of a particular language transcend the limits determined by the native language to different degrees, and consequently their expansion leads to diverging difficulties. (p. 214)

On the basis of his research he maintains (p. 225) that accurate comparison of language sound systems depends on strict attention to minute phonetic detail. In light of this, it is doubtful indeed that a few generalities about articulatory habits will take learners all the way to phonetic accuracy. Still, there exists the possibility that such generalities could make the task considerably less complex and teaching efforts considerably more effective; and so there is real motivation to pursue the study. There is a paradox in this: in order to discover the reality and the limits of articulatory settings as generalities which govern details, we must proceed by submitting the generalities to the governance of the details.

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Appendix I: Instruction Script

This instruction was presented to subjects in lecture format and distributed to them in printed form. Practice exercises appear at the end.

An Exercise in Corrective Phonetics

We are going to look at some contrasting principles of French and English pronunciation. You might notice that a few points contained in the instruction are in conflict with what you have learned up to this point. That is, in part, because there are some exaggerations in this lesson which are intended to simplify the principles you are to learn. If you notice disagreement, follow this instruction, rather than what you learned before. Here are the principles:

1. French is a language of open syllabification.

English has both open syllables (ending in a vowel) and closed syllables (ending in a consonant). When we speak, we make a pronunciation distinction between a nice man [ə-n̲aɪs-mæn] and an ice man [ən̲-aɪs-mæn]. The two phrases use the same sounds, but we still manage to distinguish one from the other by linking [n] to the following [aɪ] in the first case, and to the preceding [ə] in the second. In the same way, night rate [naɪt̲-ret] sounds different from nitrate [naɪ-t̲ret]. Inside words, where no meaning difference is at stake, we often prefer to end syllables on a consonant: we say butch-er, rather than bu-tcher, It-al-y rather than I-ta-ly, and cer-e-al rather than ce-re-al. By contrast, the French speaker doesn't have this choice: he must always end syllables on a vowel sound. French syllables may take the following forms:

V (vowel only): Italie [i-ta-li]
CV (consonant + vowel): Italie [i-ta-li]
CCV: retracer [rə-tra-se]
CCCV: distrait [di-strɛ]

However, combinations such as VC, CVC, etc. are impossible: a French syllable cannot end on a consonant. So, a French speaker, speaking English, cannot distinguish between a nice man and an ice man: both will always sound like a-ni-ceman [ə-naɪ-smæn]. Similarly, when he says a great rain, it will sound like a grey train, and night rate will sound like nitrate. Just as a French speaker must adopt new syllabification habits to improve his accent in English, you must learn to prefer the open syllable (CV, CCV, etc.) to make your French sound more "French". If you pronounce dîner as [din-e] rather than as [di-ne], you will have a noticeable, funny-sounding foreign accent.

2. French is a language of equal syllabification:

French and English syllable structures differ in other ways as well. English has a stress system which places emphasis on different syllables for each word. Look at how stress patterns change in these three words:

IN - di - cate
in - di - CA - tion
in - DIC - a - tive

In indicate, we place primary or main stress on the first syllable and secondary stress on the last; the second syllable is unstressed. In indication, primary stress and secondary stress switch places, and the second and fourth syllables remain unstressed. When we say indicative, we place primary stress on the second syllable, and the other three syllables are unstressed.

Now look at these French "relatives" of the English words above:

in - di - quer
in - di - ca - tion
in - di - ca - tive

Unlike English stress, French stress is entirely predictable. No matter what the word, the French speaker places primary stress on the final syllable of that word. He does not move it around as we do in English. We might say that all the rest of the syllables are given secondary stress and that there is really no such thing as an unstressed syllable in French.

There are more differences between French and English stress patterns. They differ, not only in where stress is placed in a word, but also in what that stress involves. In English indication, (in-di-**ca**-tion), instrumental readings show that the syllable with primary stress, -**ca**-, lasts longer and is said with more force than in- which has secondary stress. In turn, in- lasts longer and has more force than both the unstressed syllables. It is as if we cheat the unstressed syllables in order to save our strength for the burst of energy needed for the stressed syllables.

→ *English is a language of unequal syllables: stressed syllables are very different from unstressed ones in **duration and intensity**.*

By contrast, if we look at an instrumental read-out of how a French speaker says indication (in-di-ca-**tion**), we see that the first three (unstressed) syllables are almost exactly alike: they are all given equal strength and duration.

Furthermore, if we compare these syllables to stressed -**tion**, we see that they are all said with equal amounts of strength or force. The only difference is that the stressed syllable -**tion** lasts about twice as long as each of the other three.

→ *French is a language of equal syllabification: all syllables other than the final are* ***equal in duration****; stress adds only to the* ***length*** *of a syllable; all syllables are* ***equal in force****.*

To express this in the above terms, French does not cheat unstressed syllables to save energy for the stressed ones – it carefully distributes equal amounts of energy to each syllable, all the while holding just enough in reserve to double the length of the stressed syllable without increasing its intensity. To get a feeling for how a French speaker says a word, take the four-syllable anticiper as an example. Rhythmically, it sounds much as we sound if we count from 1 to 4 continuously, but without hurrying: one - two - three - **four**. Each of the first three numbers is equal in duration and intensity – none is "chewed up" for the benefit of the others. Even **four**, which we might want to call stressed, is not given more force than the others, but realizing that we have reached the end of the series, we stretch out its length to give our counting a note of finality – as if to say, "This is the end." The French speaker is doing precisely the same thing when he says the four syllables of anticiper: [ã - ti - si - **pe**]. (From the perspective of rhythm, French speech has a very staccato, perhaps even monotonous sound to it. And yet, when we listen to French conversation, we don't perceive this monotony. What happens is that, while French is spoken with less interesting rhythm patterns than English, the variation in tones (from low to high) is much wider: it produces what people often refer to as the "musicality" of French.) To make your French sound more "French", it is as important for you to maintain this syllabic equality in your speech as it is to end syllables on a vowel sound. Make a deliberate attempt to keep each syllable equal in strength to all others. Then, when you get to the final syllable, stretch out its length a little without adding extra force.

3. French final consonants are clearly released.

You may have noticed what seems to be a lie in what we have done so far. I said that there is no such thing as a French syllable that ends in a consonant; yet you all know words that end in consonants – e.g. coupe [kup]; dîne [din]. The French preference for ending syllables on vowel sounds rather than closing them off with consonants is so strong that even words like these do not have closed syllables. When a word ends in a consonant, that consonant is not linked to the preceding vowel. Rather it is pronounced on its own and followed by a puff of air to release it. This is in direct opposition to English, where we tend to "swallow" final consonants. We will look at just a few examples. In the English word coop, when we move from [u] to [p], we close our lips and hold them closed for a very short time; then, at the end of the [p], we often stop the flow of air from our lungs before we open the lips again: we don't pronounce the second half of the consonant – we don't release it or "explode" it. A similar process occurs with the [n] of dîne. We can consider that a one-syllable phonetic representation of these words ([kup] for coop, and [din] for dean) is reasonably accurate. The same does not apply for coupe and dîne in French. In this case, though they are generally represented as [kup] and [din], to be more accurate, we should show that the mouth is opened again at the end of [p] and [n] before the air flow stops. The final consonant is followed by an opening movement that is really the beginning of a new final vowel. It is pronounced much like [ə], but is usually shorter in length and may be said with or without voice – that is, spoken or whispered. Phonetically, we might represent this release as [ə̆]. Thus, a more accurate phonetic representation of coupe [kup] and dine [din] would be [ku-pə̆] and [di-nə̆] – words made up of two open (CV) syllables. (Note that in this kind of word, it is really the *second-last* syllable, with the *full* vowel, that receives the stress, rather than the [ə̆]: e.g. enveloppe [ɑ̃-vlɔ-pə̆].) If you "swallow" final consonants in French, if you fail to release them clearly, often those consonants will not even be heard.

Syllabification habits do more than affect the way we say consonants; they also "colour" our vowel pronunciation. This brings us to our next principle of French speech – really only a restatement of what has already been said:

4. French vowels are linked to the consonant(s) before them and are kept separate from the consonant(s) after them.

In English, when we close off a syllable with a consonant, we link the vowel to that following consonant. What this means is that the [i] sounds in deed [did], dean [din], and dear [dir] are not at all identical. Without going into all the ways in which final consonants can colour preceding vowels, we will consider one case. For our purposes, we can say that [did] is a fairly accurate representation of the way we say deed; but [din] is not good enough for dean.

As we say the [i], we prepare to pronounce the following [n]. In anticipation of the nasal quality of that consonant, we open the nasal passage in the middle of the vowel before – we nasalize the vowel. To show more accurately how we pronounce *dean* then, we should represent it as [dĩn]. By contrast, when a French speaker says *dîne*, since the [n] is clearly released as part of a new syllable, it is separated from the [i], and no nasalization of that vowel occurs. We might represent the pronunciation of this French word as [di-nə̆]. So, though English *deed*, *dean*, and *dear* have very different [i] sounds, the vowels of French *vide* [vi-də̆], *vine* [vi-nə̆], and *vire* [vi-rə̆] are identical. To improve your French accent, you must keep vowels separate from consonants that follow them.

Exercise 1

This exercise is to give you practice in applying the principles of open and equal syllabification. You will hear each word twice. After each stimulus, there will be a pause for you to repeat. The first time, the word will be broken clearly into open (CV, CCV, etc.) syllables; the second time, it will be said normally. Mimic the speaker on the tape as closely as possible, with a conscious attempt to keep syllables open and equal.

1. qualité: [ka-li-te] – [kalite]
2. distribue: [di-stri-by] – [distriby]
3. soigneusement: [swa-ɲø-zmɑ̃] – [swaɲøzmɑ̃]
4. corrompu: [kɔ-rɔ̃-py] – [kɔrɔ̃py]
5. appauvri: [a-po-vri] – [apovri]
6. syllabation: [si-la-ba-sjɔ̃] – [silabasjɔ̃]
7. constitution: [kɔ̃-sti-ty-sjɔ̃] – [kɔ̃stitysjɔ̃]
8. paralysie: [pa-ra-li-zi] – [paralizi]
9. refroidissant: [rə-frwa-di-sɑ̃] – [rəfrwadisɑ̃]
10. anticiper: [ɑ̃-ti-si-pe] – [ɑ̃tisipe]

Exercise 2

This exercise is to help you put into practice the principles of final consonant release and vowel-consonant separation. Again, you will hear each word twice and there will be a pause for your repetition after each. The first time, divide the word into two separated syllables with a full final [ə]; the second time, join the syllables together and shorten and de-voice the release to a puff of air [ə̆].

1. coupe: [ku-pə] – [kupə̆]
2. crêpe: [krɛ-pə] – [krɛpə̆]
3. pape: [pa-pə] – [papə̆]
4. chope: [ʃɔ-pə] – [ʃɔpə̆]
5. grippe: [gri-pə] – [gripə̆]
6. dupe: [dy-pə] – [dypə̆]
7. tripe: [tri-pə] – [tripə̆]
8. troupe: [tru-pə] – [trupə̆]
9. frappe: [fra-pə] – [frapə̆]
10. guêpe: [gɛ-pə] – [gɛpə̆]
11. donne: [dɔ-nə] – [dɔnə̆]
12. fine: [fi-nə] – [finə̆]
13. canne: [ka-nə] – [kanə̆]
14. laine: [lɛ-nə] – [lɛnə̆]
15. lune: [ly-nə] – [lynə̆]
16. tonne: [tɔ-nə] – [tɔnə̆]
17. dîne: [di-nə] – [dinə̆]
18. panne: [pa-nə] – [panə̆]
19. graine: [grɛ-nə] – [grɛnə̆]
20. dune: [dy-nə] – [dynə̆]

Appendix II: Pretest and Posttest

Items 1-3 and 67-70 were not scored.

1. qualité [kalite]
2. chope [ʃɔp]
3. corrompu [kɔrõpy]
4. automatique [otɔmatik]
5. paille [paj]
6. tu l'attrapes [tylatrap]
7. peinte [pɛ̃t]
8. grande [grãd]
9. attitude [atityd]
10. peille [pɛj]
11. c'est une blague [sɛtynblag]
12. mentez [mãte]
13. ponté [põte]
14. ratification [ratifikasjõ]
15. taille [taj]
16. pile [pil]
17. crêpe [krɛp]
18. photographie [fɔtɔgrafi]
19. étiquette [etikɛt]
20. vieille [vjɛj]
21. figue [fig]
22. pensez [pãse]
23. protestant [prɔtɛstã]
24. travaille [travaj]
25. enfile [ãfil]
26. tu la coupes [tylakup]
27. catégorie [kategɔri]
28. sommeil [sɔmɛj]
29. catalogue [katalɔg]
30. foncé [fõse]
31. pincé [pɛ̃se]
32. gratitude [gratityd]
33. poule [pul]
34. choque [ʃɔk]
35. brutaliser [brytalize]
36. fouille [fuj]
37. détermine [detɛrmin]
38. tempête [tãpɛt]
39. Rimbaud [rɛ̃bo]
40. stratégie [strateʒi]
41. sac [sak]
42. satisfaction [satisfaksjõ]
43. douille [duj]
44. elle fonctionne [ɛlfõksjɔn]
45. tombez [tõbe]
46. stratification [stratifikasjõ]
47. fenouil [fenuj]
48. béatitude [beatityd]
49. peine [pɛn]
50. enviez [ãvje]
51. grammatical [gramatikal]
52. telle [tɛl]
53. cueille [kœj]
54. glèbe [glɛb]
55. pétillant [petijã]
56. cime [sim]
57. seuil [sœj]
58. pâtisserie [patisri]
59. il dérobe [ilderɔb]
60. un problème [œ̃prɔblɛm]
61. fauteuil [fotœj]
62. lymphatique [lɛ̃fatik]
63. tube [tyb]
64. camphre [kãfr]
65. féticheur [fetiʃœr]
66. comme [kɔm]
67. triompher [triõfe]
68. paralysie [paralizi]
69. tripe [trip]
70. syllabation [silabasjõ]

Appendix III: Subject Mean Scores

Scores for all features but one are on an acceptability scale of 1 – 5, in which a score of 5 represents "French-like" realizations and 1 represents very heavily accented speech. Improvement shown is calculated by subtracting Pretest scores from Posttest scores. For Aspiration of Voiceless Initial Consonants, scores shown are in milliseconds. Improvement here is calculated as Pretest minus Posttest *in order that improvement be shown as a positive value.*

RHYTHMIC EQUALITY

Subject	Pretest	Posttest	Improvement
1. A	3.50	4.41	0.91
2. B	4.41	4.55	0.14
3. C	4.27	4.68	0.41
4. D	4.18	4.55	0.36
5. E	3.23	3.55	0.32
6. F	3.95	4.45	0.50
7. G	2.45	3.18	0.73
8. H	3.95	4.27	0.32
9. I	3.91	4.59	0.68
10. J	4.23	4.64	0.41
11. K	3.64	3.82	0.18
12. L	3.95	4.36	0.41
13. M	3.45	4.50	1.05
14. N	3.95	4.14	0.19
15. O	3.73	5.00	1.27
16. P	4.09	4.36	0.27
17. Q	4.27	4.59	0.32
18. R	4.09	4.95	0.86
19. S	4.14	4.57	0.43
20. T	3.14	3.36	0.23
21. U	3.68	4.64	0.95
22. V	3.36	3.09	-0.27
23. W	3.32	3.36	0.05
24. X	3.86	3.73	-0.14
25. Y	4.41	4.68	0.27
26. Z	3.77	4.09	0.32
SUBJECT MEANS	3.81	4.24	0.43
STANDARD DEVIATION	0.45	0.55	0.36

UNSTRESSED VOWEL CENTRALIZATION

Subject	Pretest	Posttest	Improvement
1. A	3.50	4.45	0.95
2. B	4.55	4.55	0.00
3. C	4.23	4.50	0.27
4. D	4.50	4.77	0.27
5. E	3.14	3.50	0.36
6. F	4.00	4.50	0.50
7. G	2.50	3.36	0.86
8. H	4.00	4.32	0.32
9. I	3.91	4.64	0.73
10. J	4.05	4.68	0.64
11. K	3.18	3.50	0.32
12. L	3.91	4.45	0.55
13. M	3.55	4.50	0.95
14. N	4.00	4.24	0.24
15. O	3.73	5.00	1.27
16. P	4.05	4.09	0.05
17. Q	4.32	4.55	0.23
18. R	4.32	5.00	0.68
19. S	4.33	4.67	0.33
20. T	3.05	3.18	0.14
21. U	4.00	4.55	0.55
22. V	3.41	2.82	-0.59
23. W	3.18	3.36	0.18
24. X	4.00	3.82	-0.18
25. Y	4.41	4.77	0.36
26. Z	3.82	4.05	0.23
SUBJECT MEANS	3.83	4.22	0.39
STANDARD DEVIATION	0.51	0.59	0.39

ASPIRATION OF VOICELESS INITIAL OCCLUSIVES

Subject	Pretest	Posttest	Improvement
1. A	54.2	48.5	5.7
2. B	71.1	69.4	1.7
3. C	74.2	72.0	2.2
4. D	25.7	18.9	6.9
5. E	74.6	52.5	22.1
6. F	51.4	56.3	-4.9
7. G	44.5	45.9	-1.4
8. H	67.2	51.0	16.3
9. I	69.4	64.7	4.7
10. J	74.1	69.4	4.7
11. K	49.8	50.2	-0.4
12. L	62.3	72.7	-10.4
13. M	62.0	49.3	12.7
14. N	59.9	28.7	31.2
15. O	43.0	49.9	-6.9
16. P	34.3	36.3	-2.0
17. Q	39.9	61.2	-21.3
18. R	59.8	67.7	-7.9
19. S	82.7	112.5	-29.8
20. T	82.2	63.2	19.0
21. U	54.1	52.9	1.2
22. V	53.0	54.1	-1.0
23. W	44.3	41.2	3.1
24. X	70.5	94.8	-24.3
25. Y	40.6	49.3	-8.7
26. Z	64.9	68.0	-3.1
SUBJECT MEANS	58.1	57.7	0.4
STANDARD DEVIATION	15.0	19.0	13.6

FINAL CONSONANT RELEASE – TAUGHT

Subject	Pretest	Posttest	Improvement
1. A	4.60	3.60	-1.00
2. B	4.80	5.00	0.20
3. C	4.60	2.80	-1.80
4. D	4.60	4.60	0.00
5. E	3.80	4.00	0.20
6. F	4.80	5.00	0.20
7. G	3.40	2.80	-0.60
8. H	4.20	4.80	0.60
9. I	3.80	5.00	1.20
10. J	3.20	4.20	1.00
11. K	2.00	3.20	1.20
12. L	2.00	4.20	2.20
13. M	1.80	4.40	2.60
14. N	3.60	4.00	0.40
15. O	3.80	4.80	1.00
16. P	2.60	5.00	2.40
17. Q	3.40	3.00	-0.40
18. R	4.40	2.80	-1.60
19. S	3.40	4.40	1.00
20. T	4.80	4.00	-0.80
21. U	2.00	3.80	1.80
22. V	2.80	3.00	0.20
23. W	3.60	4.80	1.20
24. X	4.00	4.20	0.20
25. Y	2.20	3.40	1.20
26. Z	3.60	5.00	1.40
SUBJECT MEANS	3.53	4.07	0.54
STANDARD DEVIATION	0.96	0.78	1.14

FINAL CONSONANT RELEASE – UNTAUGHT

Subject	Pretest	Posttest	Improvement
1. A	4.62	4.57	-0.05
2. B	4.67	4.95	0.29
3. C	4.52	4.76	0.24
4. D	4.10	4.57	0.48
5. E	4.24	4.48	0.24
6. F	4.10	4.86	0.76
7. G	3.48	3.48	0.00
8. H	4.38	5.00	0.62
9. I	4.19	4.57	0.38
10. J	4.24	4.71	0.48
11. K	3.52	4.05	0.52
12. L	3.33	4.62	1.29
13. M	2.95	5.00	2.05
14. N	4.57	4.43	-0.14
15. O	3.71	4.38	0.67
16. P	4.29	4.90	0.62
17. Q	4.10	4.33	0.24
18. R	4.52	4.67	0.14
19. S	4.57	4.52	-0.05
20. T	4.43	4.43	0.00
21. U	2.81	3.67	0.86
22. V	3.71	4.00	0.29
23. W	4.10	4.43	0.33
24. X	4.19	4.76	0.57
25. Y	3.67	4.05	0.38
26. Z	4.52	5.00	0.48
SUBJECT MEANS	4.06	4.51	0.45
STANDARD DEVIATION	0.51	0.40	0.46

WORD-FINAL YOD RELEASE

Subject	Pretest	Posttest	Improvement
1. A	3.56	4.89	1.33
2. B	4.44	4.78	0.33
3. C	4.22	4.00	-0.22
4. D	4.89	4.89	0.00
5. E	3.67	3.78	0.11
6. F	2.00	3.56	1.56
7. G	3.11	2.78	-0.33
8. H	4.22	4.67	0.44
9. I	4.11	3.89	-0.22
10. J	4.67	5.00	0.33
11. K	2.33	2.67	0.33
12. L	3.22	4.78	1.56
13. M	3.00	4.89	1.89
14. N	5.00	4.78	-0.22
15. O	4.56	5.00	0.44
16. P	5.00	5.00	0.00
17. Q	4.44	4.33	-0.11
18. R	3.33	5.00	1.67
19. S	2.89	3.11	0.22
20. T	4.78	5.00	0.22
21. U	2.67	2.89	0.22
22. V	3.67	3.56	-0.11
23. W	2.33	3.00	0.67
24. X	3.00	4.22	1.22
25. Y	4.44	4.89	0.44
26. Z	4.56	5.00	0.44
SUBJECT MEANS	3.77	4.24	0.47
STANDARD DEVIATION	0.91	0.82	0.65

YOD TIMBRE

Subject	Pretest	Posttest	Improvement
1. A	3.67	4.56	0.89
2. B	4.22	4.89	0.67
3. C	4.33	3.78	-0.56
4. D	4.89	4.89	0.00
5. E	3.78	4.33	0.56
6. F	2.44	3.67	1.22
7. G	3.11	3.11	0.00
8. H	4.22	4.44	0.22
9. I	3.89	4.00	0.11
10. J	4.44	4.89	0.44
11. K	2.33	2.22	-0.11
12. L	3.00	4.78	1.78
13. M	3.11	4.89	1.78
14. N	5.00	4.67	-0.33
15. O	4.67	5.00	0.33
16. P	4.89	5.00	0.11
17. Q	4.33	4.22	-0.11
18. R	2.67	4.89	2.22
19. S	2.56	3.11	0.56
20. T	4.78	5.00	0.22
21. U	2.67	3.11	0.44
22. V	3.67	3.78	0.11
23. W	1.89	2.67	0.78
24. X	3.00	3.78	0.78
25. Y	4.67	4.78	0.11
26. Z	4.56	5.00	0.44
SUBJECT MEANS	3.72	4.21	0.49
STANDARD DEVIATION	0.94	0.82	0.66

Appendix IV: Item Mean Scores

For all features but one, pronunciation was rated by judges on a scale of 1 – 5, in which a score of 5 represented "French-like" realizations and 1 represented very heavily accented speech. Improvement shown is calculated by subtracting Pretest scores from Posttest scores. For Aspiration of Voiceless Initial Consonants, scores shown are in milliseconds. Improvement here is calculated as Pretest minus Posttest *in order that improvement be shown as a positive value.*

RHYTHMIC EQUALITY

Item	Pretest	Posttest	Improvement
1. automatique	3.12	4.19	1.08
2. tu l'attrapes	2.54	3.85	1.31
3. attitude	4.73	4.85	0.12
4. c'est une blague	4.81	4.96	0.15
5. ratification	2.14	3.22	1.08
6. photographie	3.81	4.04	0.23
7. étiquette	4.73	4.81	0.08
8. protestant	4.19	4.35	0.15
9. tu la coupes	3.62	4.19	0.58
10. catégorie	3.04	3.38	0.35
11. catalogue	3.73	4.31	0.58
12. gratitude	4.31	4.19	-0.12
13. brutaliser	2.85	3.77	0.92
14. stratégie	4.12	4.31	0.19
15. satisfaction	4.08	4.69	0.62
16. stratification	2.77	3.00	0.23
17. béatitude	3.31	3.62	0.31
18. grammatical	3.73	4.04	0.31
19. pétillant	4.62	4.96	0.35
20. pâtisserie	4.54	4.85	0.31
21. lymphatique	4.35	4.77	0.42
22. féticheur	4.61	4.83	0.22
FEATURE MEANS	3.81	4.24	0.43
STANDARD DEVIATION	0.79	0.58	0.37

FINAL CONSONANT RELEASE – TAUGHT

Item	Pretest	Posttest	Improvement
1. tu l'attrapes	3.54	3.58	0.04
2. crêpe	4.08	4.62	0.54
3. tu la coupes	3.92	4.65	0.73
4. détermine	2.58	3.12	0.54
5. peine	3.54	4.38	0.85
FEATURE MEANS	3.53	4.07	0.54
STANDARD DEVIATION	0.58	0.69	0.31

FINAL CONSONANT RELEASE – UNTAUGHT

Item	Pretest	Posttest	Improvement
1. peinte	4.27	4.62	0.35
2. grande	4.46	4.73	0.27
3. c'est une blague	4.50	4.92	0.42
4. étiquette	4.42	4.54	0.12
5. figue	4.85	4.92	0.08
6. enfile	2.92	3.77	0.85
7. catalogue	4.73	5.00	0.27
8. gratitude	4.38	4.77	0.38
9. poule	3.31	4.31	1.00
10. choque	4.69	4.88	0.19
11. tempête	4.15	4.46	0.31
12. sac	4.85	4.92	0.08
13. béatitude	4.58	4.65	0.08
14. grammatical	3.42	3.92	0.50
15. glèbe	4.62	5.00	0.38
16. cime	3.58	4.54	0.96
17. il dérobe	4.04	4.65	0.62
18. un problème	1.42	2.65	1.23
19. lymphatique	4.77	5.00	0.23
20. tube	4.77	4.96	0.19
21. comme	2.50	3.42	0.92
FEATURE MEANS	4.06	4.51	0.45
STANDARD DEVIATION	0.90	0.60	0.35

UNSTRESSED VOWEL CENTRALIZATION

Item	Pretest	Posttest	Improvement
1. automatique	3.15	4.23	1.08
2. tu l'attrapes	2.23	3.35	1.12
3. attitude	4.81	4.85	0.04
4. c'est une blague	4.85	5.00	0.15
5. ratification	2.34	3.54	1.20
6. photographie	3.88	4.12	0.23
7. étiquette	4.88	4.77	-0.12
8. protestant	4.31	4.46	0.15
9. tu la coupes	3.35	4.15	0.81
10. catégorie	2.85	3.15	0.31
11. catalogue	3.69	4.12	0.42
12. gratitude	4.27	4.38	0.12
13. brutaliser	2.92	3.58	0.65
14. stratégie	4.08	4.19	0.12
15. satisfaction	4.27	4.77	0.50
16. stratification	2.88	3.27	0.38
17. béatitude	3.19	3.65	0.46
18. grammatical	3.88	4.23	0.35
19. pétillant	4.62	4.96	0.35
20. pâtisserie	4.77	4.69	-0.08
21. lymphatique	4.42	4.65	0.23
22. féticheur	4.60	4.79	0.19
FEATURE MEANS	3.83	4.22	0.39
STANDARD DEVIATION	0.84	0.58	0.37

ASPIRATION OF VOICELESS INITIAL OCCLUSIVES

Item	Pretest	Posttest	Improvement
1. taille	56.5	57.1	-0.6
2. pile	54.0	53.6	0.5
3. poule	66.1	67.1	-1.1
4. telle	54.8	49.6	5.2
5. camphre	60.8	61.3	-0.5
6. comme	57.7	58.3	-0.6
FEATURE MEANS	58.3	57.8	0.5
STANDARD DEVIATION	4.5	6.1	2.3

WORD-FINAL YOD RELEASE

Item	Pretest	Posttest	Improvement
1. paille	4.00	4.12	0.12
2. peille	3.50	4.23	0.73
3. taille	4.00	4.54	0.54
4. vieille	2.88	3.81	0.92
5. travaille	3.77	4.12	0.35
6. sommeil	3.27	3.81	0.54
7. cueille	4.15	4.58	0.42
8. seuil	4.15	4.65	0.50
9. fauteuil	4.23	4.35	0.12
FEATURE MEANS	3.77	4.24	0.47
STANDARD DEVIATION	0.46	0.31	0.26

YOD TIMBRE

Item	Pretest	Posttest	Improvement
1. paille	4.00	4.35	0.35
2. peille	3.62	4.27	0.65
3. taille	4.00	4.50	0.50
4. vieille	2.81	3.73	0.92
5. travaille	3.50	3.77	0.27
6. sommeil	3.19	3.77	0.58
7. cueille	4.19	4.54	0.35
8. seuil	4.15	4.69	0.54
9. fauteuil	4.04	4.27	0.23
FEATURE MEANS	3.72	4.21	0.49
STANDARD DEVIATION	0.48	0.37	0.22